DOCUMENT RESUME

ED 182 214 SO 012 267

AUTHOR Elwood, Ann
TITLE A Source Book for Connections: Technology and Change.
INSTITUTION California Univ., San Diego. Univ. Extension.
SPONS AGENCY National Endowment for the Humanities (NFAH), Washington, D.C.
PUB DATE 79
NOTE 81p.; For related documents, see SO 012 264-266
AVAILABLE FROM Boyd & Frasier Publishing Company, 3627 Sacramento Street, San Francisco, CA 94118 ($2.95)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Adult Education; Creative Thinking; Discovery Processes; Educational Objectives; *Environmental Influences; Filmographies; Futures (of Society); Higher Education; Industrialization; Inventions; *Multimedia Instruction; Program Descriptions; Resource Materials; *Social Change; Social History; *Technological Advancement; Technology
IDENTIFIERS Controversial Issues

ABSTRACT

Resource materials and suggestions are presented as part of the multimedia instructional program on relationships among science, technology, and society. The major objective of the program is to make college level course material available to the general public through cooperation of newspapers, public television, and 300 participating colleges and universities. The book is presented in four major sections. Section I presents an overview of the program, outlines major topics which can be used at weekly or monthly meetings on technology and change, explains how various community and educational groups use the program (newspaper articles, a reader/study guide, and a 10-part television series), and presents tips to teachers on how to plan and arrange publicity for a program based on technology and change topics. Section II offers suggestions for programs based on a variety of topics including technology assessment, impacts of technology on society, increasing productivity, links between nature and technology, societal values, population and resources, and economic incentives for innovation. For each topic, information is presented on background, reading assignments, discussion questions, and learning activities. Section III lists and describes activities and publications of private and governmental agencies, organizations, and museums which focus on technology and change. The final section presents a filmography of approximately 160 films on technology and change. Entries are annotated and arranged alphabetically under major course topics. (DB)

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A Source Book for Connections: Technology and Change

by

Ann Elwood

Courses by Newspaper is a project of
University Extension, University of California, San Diego
Funded by the National Endowment for the Humanities

Boyd & Fraser Publishing Company
San Francisco

SP 012 267

PREFACE

This book of resource materials and suggestions is designed for use with the eleventh Course by Newspaper, *Connections: Technology and Change*. Other components are a series of fifteen newspaper articles, a Reader, and a Study Guide. In addition, starting the week of September 30, 1979, Public Broadcasting Service television stations throughout the country will air a ten-week series of programs, *Connections,* produced by BBC and Time Life Films. A narrative book, *Connections,* by James Burke, based on the television series, and a Viewer's Guide, linking the print and video materials, are also available.

Everything in this book is planned to help program chairpersons, educators, and civic and group leaders develop community meetings based on the Course by Newspaper (CbN) topics.

The project was generously funded and supported by the National Endowment for the Humanities. It was directed by George A. Colburn, project director, and Jane L. Scheiber, editorial director, of Courses by Newspaper. The filmography was researched under the direction of Nadine Covert of the Educational Film Library Association.

Ann Elwood

A SOURCE BOOK FOR CONNECTIONS: TECHNOLOGY AND CHANGE
A Courses by Newspaper Publication

Published by Boyd & Fraser Publishing Company
3627 Sacramento Street, San Francisco, CA 94118

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ISBN 0-87835-087-X

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SECTION ONE

How to Use the Courses by Newspaper Topics

Introduction

Connections: Technology and Change

Technology is like the hammer that a do-it-yourselfer accidentally bashes a thumb with—it's a tool that makes life easier, but it can also be a cause of pain. Has technology brought us paradise or led us into nightmare? The good side: the efficiency of copiers and computers, the immediacy of television, the mobility of jet travel, the leisure brought about by a shorter work week. The bad side: poor health from contamination of our air, water, and food; a sense of disintegrating human institutions; a feeling that the future effects of technology may be detrimental. Technology has a price tag. Its influences on modern life are pervasive and obvious. Not so obvious is our impact on it.

Inescapably interwoven into everyone's life, technology and the change it brings are ideal topics for any group gathered together to enlarge their understanding of the modern world and the forces that made it as it is. The issues surrounding technology strike home. They have to do with our work, the air we breathe, our recreation, even our marriages—practically every facet of life. There is no audience that cannot gain from examining information and opinions regarding technology in order to make intelligent choices about it.

Topic Outline

The following is a list of topics that can be used for weekly or monthly meetings on technology and change. They are based on Courses by Newspaper's Fall, 1979 program, *Connections: Technology and Change.*

Part One: Technology on Trial

1. *Technology on Trial*
   Why are people ambivalent about technological change?

Part Two: Technology's Effects

2. *Silent Revolutions*
   How does technological change affect our lives and restructure our political, economic, and social institutions?
3. *How Terribly Technical!*
   How can we deal with the complexity of modern technology?
4. *Occupational Destinies*
   In what ways does the technological environment shape our working conditions?

Part Three: Conditions of Technological Development

5. *Culture: The Link Between Nature and Technology*
   How does culture provide the crucial link between nature and technology?
6. *The Influence of Societal Values*
   How do religious, ethical, aesthetic, and other social values influence the acceptance and development of technology?
7. *Technology, Population, and Resources*
   What are the technological causes of the world's alarming increase in population, and what are our options for solving this problem?

Part Four: Sources of Technological Change

8. *Incentives for Innovation: Technology and the Economy*
   Should we continue encouraging the technological innovation that causes economic growth, or should we live with less?
9. *Science and Technology: A Growing Partnership*
   How closely are science and technology intertwined, and how does their relationship affect society?

10. *The Imperatives of Engineering*

    Are the social consequences of engineering innovations taken into sufficient account?

11. *Wars: Hot and Cold*

    Has the costly process of new weapons development become an end in itself rather than a means of preserving peace?

12. *The Government's Role in Technological Change*

    What areas of science and technology should be fostered by our government, and how much funding should be devoted to research and development?

Part Five: Retrospect and Prospect

13. *The Mystery of Inventiveness*

    What is the process of invention, and what, if anything, should be done to control it?

14. *Technology and the Seamless Web: Ethical Dilemmas*

    What are the ethical issues concerning our responsibility to other humans and the natural environment brought about by the pace of technological innovation?

15. *Assessing and Directing Technology*

    How can the future course of technology be channeled to improve the lives of all humans and ensure a peaceful world?

Using the Topics to Plan Programs

A program based on the *Connections: Technology and Change* topics can be offered by any group:

- A civic, religious, or social organization or club.
- A college or university, or high school.
- A library.
- A Community Forum group (described on pages 6–7 in this section).

A group meeting can take many forms: town meeting, lecture, round table, panel, group discussion, film or slide presentation. It can be held anywhere: in someone's living room, in a hall, in a museum, in a classroom, on a lawn, or out in the field.

Those attending may be young or old, of varying educational levels, from many occupations. If your group is varied, its members can provide a stimulating diversity of opinion and a fund of rich anecdotal raw material to draw on for discussion. As leader, you may want to look for opportunities to enlarge the program by joining with other groups or opening some meetings to the public at large.

This Source Book has been specially designed to assist you in planning such programs. It is divided into four sections. The section you are reading (Section One) gives general information and some ideas for advance planning. Section Two provides sources and ideas specifically geared to each topic. Section Three is divided into three listings: (1) a descriptive list of agencies and organizations which you might contact for materials (books, pamphlets, films, and so on), as well as speakers; (2) a list of museums offering exhibits and displays that deal with technology in one form or another; and (3) a list of State Humanities Committees. Section Four is an annotated list of films on the topics.

The Courses by Newspaper Program

Courses by Newspaper (CbN) is a national program originated and administered by University Extension, University of California, San Diego, and funded by the National Endowment for the Humanities. CbN develops materials for college-level courses that are presented to the general public through the cooperation of newspapers and participating colleges and universities throughout the United States. Groups can participate in the program on several levels: those interested can read and study the newspaper articles; they can delve into the topics further with the Reader and Study Guide; they can enroll for credit at any participating college or university; or they can attend programs sponsored by community colleges and other organizations.

In addition, this offering of CbN will be linked to a television film series. Further participation is therefore possible through watching the television programs, reading the narrative volume by James Burke based on the television series, and reading the Viewer's Guide.

The Newspaper Articles. The fifteen newspaper articles, each on one of the topics listed above, will run weekly in hundreds of newspapers across the nation beginning in September, 1979. Each 1250-word article tells something about the historical factors involved in the issues at hand, describes contemporary thinking, or brings up questions for the future. The authors of the articles are scholars who are specialists in technology and change and who know how to write for general audiences.

- Although the articles are published weekly, you need not run your meetings according to their scheduled appearances in your newspaper. You might decide to discuss three of the articles at one meeting and go off on a tangent during another. Use the articles as jumping-off places, adapting the topics to your group's concerns.

• A list of newspapers that will run the articles is available from Courses by Newspaper, University Extension X-002, University of California, La Jolla, CA 92093, (714) 452-3405. If you find that no newspaper near you is publishing the series, which is free, you might want to involve one. Call (collect) or write Courses by Newspaper and ask that information be sent to you or to the newspaper editor responsible for making such decisions.

The Reader. A reader or anthology, *Technology and Change*, contains excerpts from books and journal and magazine articles pertinent to the "Connections" topics. You may wish to read parts of some of the selections to the group or have members of the group present reviews and summaries. Points of view expressed in the selections can serve as focal points for discussions or debates.

The Study Guide. Designed for students taking the course for college credit (but useful to anyone), the *Study Guide* relates the newspaper and anthology articles, highlights important concepts, and provides self-test questions and suggestions for essay assignments. It is a valuable source of background material for discussion leaders. The Reader and Study Guide are available in a combined edition.

Use the coupon on the back cover of this book to order these materials by mail or write to:

Boyd & Fraser Publishing Company
3627 Sacramento Street
San Francisco, CA 94118

Discount prices are available for groups.
All orders must be prepaid.

The BBC-TV/Time Life Television Series: CONNECTIONS

Beginning the week of September 30, 1979, the Public Broadcasting Service will run a series of ten 50-minute television programs on PBS stations throughout the country. In the series, BBC narrator and producer James Burke relates technology and human values with wit and drama. The first program introduces the concept that technological change occurs in response to "triggers." In the next eight programs, Burke traces the evolution of eight modern inventions so triggered—the atomic bomb, telecommunications, the computer, the production line, the jet aircraft, plastics, rocketry, and television—from their beginnings or earliest counterparts. The tenth program presents prospects for the future. Contact your local PBS station to obtain an exact schedule for the local air dates for the *Connections* series. You might want to center some of your meetings on the programs. If you wish to purchase the series or individual programs in it, you may do so by writing Time Life Multi-Media, Room 3248, 1271 Avenue of the Americas, New York, NY 10020. The ten-program package is priced at $6000 (film) and $3000 (video). Individual programs are priced at $750 (film) and $375 (video). Films may also be rented through university film centers. To find out the one nearest you, write to Time Life Multi-Media, at the same address.

Connections, a lavishly illustrated narrative volume, written by James Burke and based on the television series, is available as part of the educational package from Boyd & Fraser at the above address.

The Viewer's Guide ties major themes in the television series to the newspaper articles and the articles in the Reader. It is available from Boyd & Fraser.

Who Else Is Involved?

Before you plan your meetings, find out if other groups in the community are involved in a program based on the topics in *Connections: Technology and Change*. You might want to engage in cooperative efforts with them, or initiate a combined program.

Colleges. Many colleges are offering the course, *Connections: Technology and Change,* for credit or non-credit. If a college near you is doing so, you may want to suggest that members of your group attend classes, or you may want to go as a group to special meetings to which the public is invited. Often colleges present speakers or films related to the topics. A list of participating colleges and universities is available from Courses by Newspaper, University Extension X-002, University of California, La Jolla, CA 92093, (714) 452-3405.

Community Forums. As with past courses, Courses by Newspaper's series serves as the basis of community programs planned by participating newspapers and educational institutions. During 1977-1978, CbN Forums, demonstration community humanities programs conducted at eleven community and junior colleges throughout the country, provided opportunities for citizens to discuss issues raised by the CbN articles and supplementary materials.

The forums were developed by the American Association of Community and Junior Colleges, with a grant from the National Endowment for the Humanities. Featuring a discussion period led by local experts and the college faculty, each forum was designed to involve all facets of both college and community. Free

and open to the public, the forums were accompanied by additional features such as dramatic presentations, film series, television and radio broadcasts, demonstrations, book reviews, library exhibits, and locally prepared articles.

During 1978-1979 representatives from over 400 community colleges attended workshops at various locations across the country to learn how to develop community forums based upon Courses by Newspaper topics and materials. The information and materials distributed at the workshops are available from the Community Forums Office at the American Association of Community and Junior Colleges. For copies of the Community Forums Planning Packet, case studies, and other print and video materials designed to facilitate the presentation of local forum programs, contact: Diane U. Eisenberg, Director, Community Forums Office, AACJC, One Dupont Circle, N.W., Suite 410, Washington, DC 20036, or call (202) 293-7050.

Museums. The American Association of Museums will be actively cooperating with Courses by Newspaper's program, *Connections: Technology and Change*. Information about the CbN program, Idea Kits, brochures, and other materials have been sent to member institutions so that they know about the course and can plan exhibits and displays related to course topics. If your local museum has not received these materials, encourage its director to write to: American Association of Museums, Cultural Services Group, Box 241, New York, NY 10024.

Libraries. Public libraries throughout the United States are offering programs based on *Connections: Technology and Change* topics. A few model projects have been funded with National Endowment for the Humanities grants awarded by the American Library Association. These grant funds can be used for publicity, hiring speakers, renting or buying films, and other program expenses. You may wish to work with your library to develop a program or join with the library staff in cosponsorship of one or more meetings. To find out if a library near you is planning an ALA-NEH-sponsored *Connections: Technology and Change* program, write to Peggy O'Donnell, Project Director, American Library Association, 50 East Huron, Chicago, IL 60611.

Advance Planning

Sending Away for Materials and Contacting Speakers. Start planning your program as soon as possible. Skimming through this *Source Book* in advance can save you many headaches. Practically speaking, it's a good idea to write for materials and arrange for speakers and film showings at least a month in advance. When arranging for speakers, try whenever possible to contact local branches of national organizations and government agencies—it will save time. Consider asking local people to speak or participate in panel discussions—industrial leaders (and workers), businesspeople, union personnel, museum officials, educators. The people you ask need not be in the public eye or high in a hierarchy. (Who knows more about the effects of technology than a worker displaced by a new machine or an elderly person who has been an eyewitness to the coming of a Technological Age?) Check with your librarian (because libraries are often clearinghouses for the community) and with educational institutions (including college departments such as Economics, Political Science, History, Sociology, and Philosophy), as well as in the yellow pages of the telephone book for possible speakers and representatives of concerned organizations.

Arranging for Publicity. To involve the community in your program, you will want to do more than send out meeting announcements to your group. The best sources of publicity are the newspaper carrying the CbN series and the PBS station featuring the CONNECTIONS series. To all media, supply a schedule of group meetings, annotated with special mention of outstanding events (speakers, films, and so on), and plan for press releases. Encourage media coverage of sessions. Other ideas: put up posters (available from Courses by Newspaper) and leave handouts in libraries, educational institutions, supermarkets, and laundries.

For College Instructors

Courses by Newspaper encourages college instructors to enrich their classroom sessions and to hold additional meetings, beyond the two required contact sessions, with their students. In order to maintain the flexibility of the program, however, it is suggested that these additional meetings be optional. You might want to consider opening some of them to the general public.

This *Source Books* should be of aid in suggesting program ideas, possible sources for speakers, and films that can spark lively discussions. Do not overlook colleagues, in your own or other departments, who might bring a variety of perspectives to this interdisciplinary course.

SECTION TWO

Program Suggestions

All the suggestions in this section are only idea-generators, springboards, jumping-off places. Your best sources of ideas are the people in your group—from them should come life experiences, a variety of opinions, and suggestions for things to do. So adapt, change, and select from the *Source Book* as you wish. Of course, there are far too many programs suggested for one group to use—a number of ideas have been included for each topic so that you will have a choice.

The Background for each topic includes some suggestions for reading—from the anthology, as well as from books and periodicals available in most libraries. You might want to summarize these for the group or bring them to meetings to share. In addition, you may have handouts and other materials you have obtained from the organizations listed in Section Three. And if all this is not enough, haunt your library for more. Articles and books are being written all the time on topics related to technology. Consider clipping feature articles on technology from your newspaper, particularly articles of local interest. Involve members of the group in looking for material, also.

Suggested Discussion Questions are, of course, just that—adapt them to the needs and interests of your group.

In Program Suggestions and Resources, several meeting formats are suggested—panel discussions, small-group activities, debates, speakers, films, short trips "into the field." They have been intentionally designed to involve the group actively in what is going on. For some meetings, you might want to consider inviting people outside your own group.

For field trips—to a factory or museum, for example—be sure to set specific goals and to end with a discussion that ties the experience of the trip to the topic at hand. If you have asked someone else to lead the excursion—a factory manager, for example—give that person an indication of what your purposes are so that he or she can plan comments accordingly.

In several instances, program suggestions include writing scenarios. If your group has had no experience with this, explain that people make up scenarios—imaginative scenes or story plots about what might happen in the future—all the time. Suggest some simple ones: What will happen if my car breaks down? What will happen if X is elected as mayor? For most groups, it is probably best to keep scenarios in the form of narratives, perhaps set up as diaries of fictional people caught in time machines or visiting a place after a long absence. If alternative scenarios seem desirable ("best-worst"; in 20 years, in 30 years; etc.), you might consider assigning each alternative to a small sub-group of five or six people.

1 Technology on Trial

". . . it is only through our collective wisdom that the problems concerning technological advance and its cultural effects can be resolved."
John G. Burke

Wiped out by weedkillers, dandelions are becoming a rarity in England. "It won't be long before we have children asking what a dandelion is," said a representative from London's Kew Gardens, where dandelions recently went on exhibit. Groups in England started a campaign to save the once-hated weed.

Background

From the Courses by Newspaper Reader

• See "Are We Really in Control?" by Barry Commoner; "The Technique of Total Control" by Lewis Mumford; "The Technological Order" by Jacques Ellul; "In Praise of Technology" by Samuel C. Florman.

From Popular Periodicals

• "Technology and Technology Assessment" is the subject of the fall 1978 issue of *National Forum*, The Phi Kappa Phi Journal. Individual articles deal with judging the appropriateness of technology, technology in the future, the impact of technology on work, ethical problems resulting from new technologies in the fields of death and dying and medical research, and nuclear energy. (*National Forum*, Fall 1978. If not available in your library, this journal may be obtained for $1.50 per copy by writing National Forum, Box 1942A, East Tennessee State University, Johnson City, TN 37601.)

• The ambiguous message of movies like *Star Wars* and *Close Encounters of the Third Kind* mirrors our ambivalent attitudes about technology, says Carll Tucker in "Our Love-Hate Affair with Technology." Though technocrats seem to be responsible for damaging the earth, we're dependent on them. "For every wonderful achievement, technology seems to deal us an equivalent kick in the shins." (*Saturday Review*, December 10, 1977, page 80)

• Our attitudes toward technology reach two polarities: (1) the universe is there for us to exploit, which "leads to the collapse of all values" so that in the end we manipulate humans, too, through social engineering, and (2) we can control technology if we use it for more humane social purposes. ("Technology's Effect on American Society," *Intellect*, May, 1978, pages 441–442)

• Efforts are being made in England to put "appropriate technology" ("What can be smaller should be") into operation. Joan Jennings provides some details in "Human Scale Industry: The Idea Grows in England." (*Organic Gardening and Farming*, July, 1976, pages 26–29)

• Has the United States turned hostile to technological innovation? A revision of Federal policy on industrial research and developing and innovation is discussed in an article in *Business Week*. ("Vanishing Innovation," *Business Week*, July 3, 1978, pages 46–49)

• Stewart Brand, the creator of *Whole Earth Catalog*, explains his views on space colonies and "appropriate technology" in an interview with Wade Greene. (Wade Greene, "The Selling of Soft Tech," *Psychology Today*, November, 1978, pages 70–78, 120)

Books to Review

• In *Technology and Social Shock*, Edward B. Lawless documents 45 case histories of controversial problems engendered by science and technology. (New Brunswick, N.J.: Rutgers University Press, 1977)

• Samuel C. Florman's articulate examination of the role of the engineer in contemporary society in *The Existential Pleasures of Engineering* confronts the arguments of the anti-technologists. (New York: St. Martin's Press, 1976)

Suggested Discussion Questions

• What are some recent disclosures of dangers in technology that have existed for some time but have only recently been revealed? (Consider effects of radiation and asbestos on workers, flammability of urethane foam.) Why did it take so long for the news to leak out?

• In what ways has technology saved lives that otherwise would have been lost?

• Do you agree that technology is moving too fast? How is it affecting government agencies? Institutions like marriage and religion? Education? Work? Recreation?

• Describe the stages Americans have gone through in their love affair with technology in the last thirty years. Why do some of us seem sour on technology now?

Program Suggestions and Resources

In the Headlines. Analyze a current newspaper to determine how many stories could not have appeared ten or twenty years ago because they are based on modern technology. (Examples: computer fraud, disputes over weapons, etc.) What were the issues in the news then as compared to now?

Tape Record a Time Capsule. Ask members of the group these questions: How has technology affected your life? How much should it be controlled? How can we solve the problems it causes? Tape record their answers and save the recording to be played at the last meeting.

Less Is More. More Is More. Invite an economics expert, a scientist or technologist, a businessman, and a high-school drop-out to take part in a panel. Ask them to discuss the effects of technology on their lives, government regulation related to technological advance, the idea that "less is more" (putting the lid on overuse of technological innovations and energy).

Out of Control? Ask the group to debate the question of whether or not technology is "out of control."

Getting Geared Up. Any one of the films suggested in "The Poetry of Technology" in the Filmography (page 56) will serve as an excellent introduction to the topic, and should generate a lively discussion.

Is It All Déjà Vu? Show *The Mystery of the Anasazi,* which reaches the conclusion that North America's first city-dwellers, the Basket Makers and Stone Age People of the Anasazi, may have been forced to leave their land after they used up all their natural resources. Invite an anthropologist and an economist to discuss the film, and the questions it raises about modern times, with the members of the group.

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2 Silent Revolutions

". . . technology is first and foremost a 'humanity.' Technologies are not created by nature or by elves in the Black Forest. . . . They . . . pose new human options, create new human opportunities, and demand new human answers. Technology liberates . . ." Peter F. Drucker

When Queen Victoria asked Michael Faraday of what possible use his new discoveries in electricity and magnetism might be, his answer was, "Madame, of what use is a baby?"

Background

From the Courses by Newspaper Reader

• See "The First Technological Revolution and Its Lessons" by Peter F. Drucker; "The Industrial Revolution" by T. S. Ashton; "Technology and Culture in Evolution" by J. Bronowski.

From Popular Periodicals

• In the labor shortage of the Revolutionary War era, American women ran farms and engaged in trade. The advent of the factory in the first half of the nineteenth century did not bring women further economic freedom, as might be suspected, but instead forced them back into the house. In an excerpt from their book *Remember the Ladies: Women in America, 1750–1815,* Linda Grant de Pauw and K. Conover Hunt tell the story. (*Ladies' Home Journal,* July, 1976, page 30)

• Carl Sagan, in "In Praise of Science and Technology," ponders the often unforeseen impact of inventions on the character of society. Technology is "a tool, not a panacea," he says, and calls for research groups to predict and "defuse" future catastrophes that might result from technology. (*New Republic,* January 22, 1977, pages 21–22)

• The entire March, 1977 issue of *Science* is devoted to the electronics revolution. Several articles deal with the technical aspects of computers. However, others deal with the effects of the "revolution" on communications, the workplace, education, medicine, and defense. (*Science,* March, 1977)

• In "How Technology Will Reshape Life in the Years Ahead," research and possible future effects of computers, transportation innovations, and other technological advances are discussed. (*U.S. News and World Report,* November 28, 1977, pages 62–68)

• "What Life Will Be Like in the 1980s" examines the effects of technology on the lives of the ordinary citizen, government planner, scholar, business person. (*U.S. News and World Report,* December 26, 1977, pages 75–86)

Books to Review

• How much has the development of humankind been influenced by the invention of tools and the conquest of nature? Lewis Mumford's answer is that we have exaggerated the importance of technology to the

ascendancy of men and women on earth, that we are not ruled by the machine as much as some experts would have us believe, and that other factors—religious and irrational—have been highly significant, even in science. (Lewis Mumford, *The Myth of the Machine*. New York: Harcourt Brace Jovanovich, Inc., 1966)

• *Earth Abides*, a science fiction novel, chronicles the enormous changes wrought by the slow collapse of complex technology on one family which survives a world catastrophe (fatal epidemic). As machines and systems moulder and rust into dysfunction, each succeeding generation becomes more primitive than the last. (George R. Stewart, *Earth Abides*. Boston: Houghton Mifflin Company, 1949)

Suggested Discussion Questions

• What modern inventions have started social revolutions on a scale comparable to those begun by the sewing machine? (Consider miniaturized circuitry or copying machines.) What would life have been like without those inventions?

• Do you agree with Drucker's statement: "What these examples show is... that technology is not something outside of society. It is society itself."? Explain your answer.

• Why has society refused to accept certain recent technological advances like the Picturephone, the SST, electronic supermarket checkouts? Why has it, on the other hand, so readily embraced such devices as CB radio and the microwave oven?

• Discuss the long-range effects of some key inventions: barbed wire, the jet engine, and radio. Can technology provide decentralization of food and energy supplies, or is our society too complex for that?

Program Suggestions and Resources

Television: Angel of Devil? Debate the intrinsic worth of television as a medium. Consider: the possible passivity engendered by television watching, the potential of television to educate, television's effect on developing nations, the possibility that television might be a factor in the creation of a "world mind," the role efficient communication could play in saving energy. The debate might feature a spokesperson from a television network and a member of a parent-teacher's organization that is hostile to television. A professor of communications at a local community college might serve as moderator.

The Computer Revolution. Ask a panel of people, some of them members of the group, to discuss the impact of the computer on their lives. Even in small towns, the computer has had a profound influence on everyday systems: the bank, the school, the post office, the library, the farm. Representatives of those systems might compare notes and predict future developments in computer use.

In the Olden Days. More than two-thirds of the inventions most influential in modern life were created after 1850. People alive today have seen extreme change in patterns of society because of those inventions: e.g., the automobile, telephone, jet plane. Convene a panel of people of various ages to tell about the technological advances they have witnessed in their lifetimes. How was an average day twenty-five years ago different from an average day today—just because of technology? Have one member of the panel research the predictions of the World of Tomorrow at the 1939 World's Fair. Which predictions have come to pass? Which did not? Why?

Of Women and Men. Ask a group of women—professional, blue-collar worker, housewife—to talk about the significance of technology in their lives—marriage, work, motherhood. What problems are created by technology? What problems are solved by it? Is there a net gain or net loss? As counterpoint, a group of men might compare notes on how the revolution in women's lives has affected them.

How Different? View the film *Old Treasures from New China*. Follow the film with a discussion on how China's "silent revolutions" differed from those in the West—and why. Compare the roles of women as related to technological advance in the two cultures.

3 How Terribly Technical!

"The traditional answer to ignorant domination by technologies is education, but it is still only a partial solution to an irritating and desperate problem."
Derek de Solla Price

A computer program set up to translate scientific reports rendered the English phrase "hydraulic ram" as "water sheep" in Russian.

Background

From the Courses by Newspaper Reader

• See "The All-Seeing Eye" by Lewis Mumford; "What Computers Mean for Man and Society" by Herbert A. Simon; "The Citadel of Expertise" by Theodore Roszak.

From Popular Periodicals

• The average person mystified by technology often fails to be much enlightened by books for the layman that seek to explain the inner workings of technological devices in simple language. For a tongue-in-cheek spoof of explanations for the common man (including delightfully murky descriptions of the light bulb and television), see "How Things Don't Work" by Marshall Brickman (*New Times*, January 9, 1978, pages 60–61).

• Barry M. Casper, a prominent physicist, describes alternatives to the often-secret alliances made by bureaucrats and technocrats in long-range technological planning. He calls for more democratic control of technology policy. ("Technology Policy and Democracy," *Science*, October 1, 1976, pages 29–34)

• The arguments surrounding technological issues are often complex, and the dangers of technological advances are often not apparent until years after they are put into operation. Witness electromagnetic pollution, a.k.a. "electrical smog." ("The Flap Over the Zap," *Newsweek*, July 17, 1978, page 87)

• Buckminster Fuller advocates a "cosmic" accounting system, involving a massive international power grid, to do away with inefficient use of technology. ("Using Technology for the World," *Current*, September 1976, pages 13–15)

• *Time* reviews *The Encyclopedia of Ignorance*, a 450-page volume about what human beings, scientists among them, *don't* know. ("Outer Limits," *Time*, January 9, 1978, page 60)

• Before the Industrial Revolution, women showed they were capable of hard work by laboring up to sixteen hours a day on farms. Why, then, were they not more readily accepted as factory workers when the first mills were put into operation in the United States? Elise Boulding and Jean Driscoll discuss this question in "Toward a New Kind of Human Being." (*Current*, May/June, 1976, pages 9–15)

Books to Review

• People like Paul Ehrlich, Linus Pauling, B. F. Skinner, Carl Sagan, and Barry Commoner—"the visible scientists"—are articulate showmen, with strong reputations as scientists and strong opinions, which they discuss in newspaper interviews, in popular books, and on talk shows. Their impact on public opinion is enormous. Rae Goodell traces the development of this phenomenon from the 1960s, when, she says, the advisory system between science and government began to fall apart. (*The Visible Scientists*. Boston: Little, Brown and Company, 1975)

• Technophobia, claims Hal Hellman, comes from ignorance, and too many American citizens are technological illiterates. In this highly entertaining book, he argues that we are not inundated with new information as much as we may think (just the same information over and over) and that it is possible for most people to understand enough of what's going on in technology to deal with it. (*Technophobia: Getting Out of the Technology Trap*. New York: M. Evans and Company, Inc., 1976)

Suggested Discussion Questions

• Why does the material in scientific and technical journals so often seem stiffly and obscurely written? Is this a deliberate attempt on the part of the experts to keep knowledge from the public? What other factors might account for the style of these journals? Of what value are scientific/technical journals to the experts? To society?

• Is control of technology beyond the reach of the average person? Is it possible for the layman to make intelligent decisions about technological issues? How might such decisions be relayed to those in charge? Should we force the disclosure of technological secrets?

• Does increased specialization automatically close out the possibility of broad understanding of technology by everyone? Is there, in other words, just too much complexity, just too much to understand? What can be done to increase technological literacy?

Program Suggestions and Resources

The Question of Conspiracy. One often hears that the scientific/technological elite is conducting a conspiracy to keep information from the public. Is this idea paranoid or based on reality? Engage the group in a debate on the question of such a conspiracy—is it real? The debate might be led by a scientist and a member of a consumer or citizens' group (such as the League of Women Voters).

Explanations. Ask someone from a specialized field—perhaps a member of the group—to explain a work-related process in layman's terms. Does the person have difficulty? If so, ask him/her to tell why. Do such explanations, no matter how clear, leave something to be desired in terms of absolute accuracy?

Science Museum. Science museums often offer step-by-step explanations, cutaway models, working models, audiovisual shows, and other devices that make it easier for the non-expert to understand technological processes. A visit to such a museum—during which the museum's explanatory techniques as well as the displays themselves are analyzed—can throw light on some of the issues brought up in Price's article.

Two Sides. Industrial processes can be dangerous to workers. Nuclear energy plants may not be defensible in terms of human safety. On issues like these, the evidence to back opposing sides of the debate may be difficult to understand and evaluate. Invite a speaker from an organization or industry to defend an industrial process or nuclear energy plant from the attack by another speaker from an opposing group. Allow enough time to analyze the arguments. How has each speaker arranged statistics to show his/her position in the best light? Did either use deliberately vague or obscure language? Can the average person reach an intelligent decision on the issue after hearing the speakers, or does one have to be an expert in order to do so?

The Status Quo. After showing the film *The Starry Messenger*, which portrays the rejection of new ideas by the establishment of Galileo's day, discuss: What scientific ideas and technological innovations are being rejected by various establishments today? Why? You might ask a technologist or scientist to lead the discussion.

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4 Occupational Destinies

"Workers do not typically welcome innovations in production technology—far from it. Nor are they mistaken in their apprehensions about new techniques." Joseph C. Gies

When the Chicago factory robot Clyde the Claw broke down, his human co-workers sent him flowers.

Background

From the Courses by Newspaper Reader

• See "Dynamo and Virgin Reconsidered" by Lynn White, Jr.; "Worker Alienation" by Gary Brynner and Dan Clark; "Automation" by Marshall McLuhan.

From Popular Periodicals

• Current ways of dealing with worker frustration caused by "empty jobs" (which, in turn, are at least partially the result of technological systems) include giving workers a voice in job and management decisions, providing more flexible work schedules, creating worker committees and work teams. A. H. Raskin discusses why labor union often oppose such measures and why workers are represented on corporate boards of directors in European countries and not in the United States. ("The Heresy of Worker Participation," *Psychology Today*, February, 1977, page 111)

• The Scanlon Plan, an incentive system for workers with boring jobs, has been implemented at the Dana Corporation, which produces car and truck parts. Dana Corporation has highly automated assembly lines and a closed-circuit television communications system. The highly successful results of the Scanlon Plan are discussed in "How to Keep Workers Happy on the Job." (*U.S. News and World Report*, December 26, 1977/January 2, 1978, pages 85–86)

• An exploration of the question of occupational boredom, often brought on by technology, yields some surprising answers, according to *U.S. News and World Report*. ("Those 'Boring' Jobs—Not All That Dull," *U.S. News and World Report*, December 1, 1975, pages 64–65)

• When American workers toured factories in Sweden, they expressed some misgivings about Sweden's new methods. ("Doubting Sweden's Way," *Time*, March 10, 1975, page 46)

• Why are so many working women confined to the "employment ghetto"? How real is women's freedom from long hours of housework, which was won by technology? How can the problems of working women be solved? Some answers are given in a *Newsweek* article, "Women at Work." (*Newsweek*, December 6, 1976, pages 68–70)

• In West Germany, labor resists automation. *Die Zeit*'s economics editor analyzes some of the factors involved. (H. Jungblut, "Technology and Unemployment," *Atlas*, October, 1978, page 56)

Books to Review

• The trend in Europe and America is toward increasing productivity, worker pride, and job satisfaction through changing or eliminating "dumb jobs" and the dehumanized assembly line. Some jobs have disappeared because of automation or are being handled by mechanical robots. The trend has affected the labor force, factory design, and management decisions. (Paul Dickson, *The Future of the Workplace: The Coming Revolution in Jobs*. New York: Weybright and Talley, 1975)

• *Work in America* is a large-scale study of the effects on workers of workplace conditions. (U.S. Department of Health, Education and Welfare. Cambridge, Mass.: MIT Press, 1972)

Suggested Discussion Questions

• By increasing productivity, technology has caused a shorter workday. What problems has this created? How might those problems be solved? Is it possible that people will relegate work to a less important place in their lives and find ego satisfaction elsewhere? Or will work have to change to suit the worker?

• What psychological needs are violated by technological advances like specialization, scientific management, the moving assembly line?

• It is possible to perform many boring and dangerous tasks with sophisticated robots, yet robots are not widely used in industry, even though in the long run they are more economical—they don't take coffee breaks and will work 24-hour shifts. Why not?

• What is the relationship between labor shortages (and surpluses) and society's attitude toward technological advances?

Program Suggestions and Resources

On the Scene. Arrange for the group to visit a factory. Have the factory foreman point out the presence of modern technology in the form of machines, assembly lines, and other devices and systems. How have these technological systems increased productivity? How many unskilled workers are employed in the factory now as compared with ten years ago? Twenty years ago? How has the composition of the work force changed because of technology? How have these changes affected relations with the union, if there is one?

Tote That Barge, Lift That Bale. Invite two psychologists to debate the question: Human beings need to work to be happy. Considerations: Does it matter if the work is salaried? Does the work have to be meaningful? Do some people *like* their jobs to be boring?

The Servant of Man. Convene a panel composed of a corporation manager, a union leader, a government representative, a worker. Lead a discussion about the place of technology in business and industry. Does productivity always supersede worker satisfaction as a priority with businessmen? Should some technological advances be delayed? How can business organizations be changed to increase worker satisfaction in spite of boredom created by technology?

As It Was and Is. View the film *Inheritance*, which compares the work of three artisans and three modern assembly lines. Following the film, an old-time craftsman might discuss how technological change has (or has not) affected his work. Possibilities: a piano tuner, a shoemaker, a tool-and-die maker, a seamstress, a cabinet-maker.

5 Culture: The Link Between Nature and Technology

"People wish to keep their customs, traditions, religions, languages, arts, and literatures. Many of these are intimately concerned with their attitudes toward their natural surroundings and to their tools, whether they are computers or digging sticks." Clarence J. Glacken

Centuries ago, the Aztecs developed *chinampa*, a system of agriculture in which water channels separating plots of ground were connected to an irrigation network from higher levels. Rich mud from the channel bottom was used to nurture seedlings. This ancient system, ecologically benign, is being considered by modern agricultural experts as a new technology to replace destructive slash-and-burn farming, in which trees are burned and crops planted among the ashes.

Background

From the Courses by Newspaper Reader

• See "Nature and Culture in Western Thought" by Clarence J. Glacken; "Environmental Pollution in the Middle Ages" by Jean Gimpel; "The New Environmental Attitude" by René Dubos.

From Popular Periodicals

• Deforestation and encroaching deserts in Espiritu Santo, South America, are throwing the ecosystem off balance. The results, discussed in "Deforestation and Disaster," include the disappearance of 450 varieties of plants and 204 species of birds; an increase in the number of pests and parasites; and more skin cancer in the people, who are not used to so much sun. (*Time*, May 22, 1978, page 95)

• The possibilities of using ancient Indian methods of agriculture are discussed in an article in *Human Nature* ("Aztec Agriculture," *Human Nature*, January, 1979, page 15)

• In "The Barbarian Within," *Harper's* editor Lewis H. Lapham takes a long view of the soft technologies of our time. (*Harper's Magazine*, February, 1978)

• The question of how to tailor energy programs to the specific cultural preferences of an underdeveloped country is explored by Janet Raloff in "The Third World Needs Energy, Too." (*Science News*, October 8, 1977, pages 234–235)

• The extent to which the culture of Japan has contributed to the successful utilization of technology in that country is discussed by John H. Douglas in "Japanese Science and Technology (1): The Coming Challenge." (*Science News*, December 3, 1977, pages 378–381)

• A computer model of a world system is used to illustrate an article on the complexity of our interdependent world. One of the factors explored is technology. (Alexander King, "Report on the Planet, 1978," *Human Nature*, December, 1978, pages 77–83)

Books to Review

• In *Silent Spring*, Rachel Carson calls attention to the consequences of chemical pesticides for the natural environment. This book was instrumental in launching the environmental movement. (Boston: Houghton Mifflin, 1962)

• For a comprehensive work on the effects of human beings on modification of the natural environment, see *Man's Role in Changing the Face of the Earth*, edited by William L. Thomas, Jr. (Chicago: University of Chicago Press, 1956)

Suggested Discussion Questions

• A recent concept of the world as a total fragile ecosystem was contained in the phrase "Spaceship Earth," popularized by ecologists. Is that concept still valid? How does it differ from the ideas of the environment held by many people in the 1800s and early 1900s? Has technology changed it? How?

• Do you agree with people who say that "necessity is the mother of invention," that nature sets problems for people to solve through technological and other means? What evidence of this exists? What evidence refutes it?

• In the San Joaquin Valley in California, modern irrigation methods are beginning to turn fertile lands into desert. In more primitive areas of the world, the cutting down of trees for firewood is also bringing desertification. Of course, technology damages the earth in other ways—air pollution, for example. What are some of those damaging practices? How can detrimental effects of technology on the environment be avoided?

Program Suggestions and Resources

Artificial Nature. Environmentalists hold varying opinions on the management of wild lands. What is the natural life of an estuary? Is there any reason to prolong its life artificially? What happens to a piece of wilderness shrunken by encroaching urbanization?

Invite an environmentalist to discuss with the group the question: How much should we interfere in natural processes to maintain wild lands in a seemingly natural state?

Culture and Nature—The Chicken or the Egg? How do culture and nature interact in present-day societies in the United States—in cities, on farms, on Indian reservations, in national parks? Invite a panel to discuss this: an anthropologist, an agricultural expert, a sociologist, and a technologist.

Walk on the Wild Side. After viewing the film *Boomsville*, take a field trip through a section of your area where there is an obvious natural feature such as a river, lake, canyon, or beach. Observe, with an environmentalist or natural scientist, the ways in which technology has changed that natural feature. Does it need to be restored? Through what technological means might that be accomplished?

Take a Position. In his article, Glacken discusses two opposing streams of thought: an optimistic belief that science and technology can manage the environment "indefinitely for continuing human use" and a pessimistic belief that nature's delicate balances are too easily destroyed by fallible human beings with "only partial knowledge of extremely complex interrelationships." Ask the group to take opposing sides (optimistic and pessimistic) to debate this issue.

6 The Influence of Societal Values

"Technological activities are initiated to meet social needs. The crucial question, then, is how are social needs determined. In America the traditional answer has been market demand." Edwin T. Layton, Jr.

By 1926, the practical, black Model T Ford began to lose its popularity—the American public was becoming interested in comfort and good looks in a car. Henry Ford, unbelieving at first, came to terms with the new trend and produced the more luxurious Model A, nicknamed "the baby Lincoln," available in Niagara blue, Arabian sand, Dawn grey, and Gunmetal blue.

Background

From the Courses by Newspaper Reader

• See "Do Machines Make History?" by Robert L. Heilbroner; "Technology as Environment" by William F. Ogburn; "Technological Change and Social Change" by George H. Daniels.

From Popular Periodicals

• Is our mania for convenience causing waste problems? Is it true they "just don't make them like they used to"? The planned obsolescence of household appliances and the marketing of throwaway containers add to the nation's solid waste problems. Denis Hayes, a senior researcher with the Worldwatch Institute, discusses ways in which technology can reduce rather than encourage waste in "Waste Not, Want Not." (*Environmental Action*, November 18, 1978, pages 14–15)

• Pressure from consumers, reflected in government regulations, is forcing Detroit automobile makers to produce smaller cars, as discussed in "Something a Little Smaller." (*Forbes*, January 22, 1979, pages 80–81)

• The lack of market acceptance that can cause a technological innovation to fall flat on its face is analyzed in "What Went Wrong? Anatomy of Failures." (*Science News*, November 27, 1976, page 343)

• Are the American people likely to adopt teleconferencing through telephone and television as a replacement for the business trip? It's more economical in terms of time and money, but, according to Ned Potter, "not likely to catch on with us regular human beings." Along with a quick rundown of breakthroughs in communication made possible through fiber optics, this article describes Peter Goldmark's concept of NRS (New Rural Society) which could technologically, if not popularly, come to pass once this technological innovation is perfected. (Ned Potter, "The New Phone Age," *New York*, December 18, 1978, pages 64–66)

Books to Review

• In *Social Change with Respect to Culture and Original Nature*, William F. Ogburn presents the theory of "social lag," which postulates that society only gradually adapts to changes created by technological innovations. (New York: Viking Press, Inc., 1923)

• *The Arts in Modern American Civilization*, by John A. Kouwenhoven, is an analysis of how technology and art in the United States were shaped by the American experience. (New York: W. W. Norton, Inc., 1967)

Suggested Discussion Questions

• We complain that the computer and other elec-

tronic devices invade our privacy, yet as a society we do nothing to control these devices. In fact, we encourage their use. Are we ambivalent about this issue (and others that are similar)? Do we, on some level, want our privacy—or at least that of others—lost to machines? Why?

- How are social needs reflected in the inventions that we adopt? Consider: the need for closeness in an alienated society (alienated to some extent *because of* technology), the need for immediate gratification, for speed? How have these needs been partially met by technology? How did technology create these needs?

- What evidences of social lag (society's slow adaptation to technological change) are presently apparent? How is society dealing with social lag? What might be the end result of social lag?

- Recently, there has been much concern about the "quality of life" in contemporary society. If the market economy does not provide the best criteria for directing technology, what *are* the best criteria?

Program Suggestions and Resources

Ask the Person Who Makes It. Which comes first—consumer desire or company product development? How much does a business consider the needs of the consumer in developing a new product? Invite one or more marketing executives from business and a representative from a consumer group to discuss with the group to what degree businesses take current popular trends into account when designing new products and the ways in which the marketplace is measured—and manipulated.

Selling the Sizzle. Collect several brochures from automobile agencies for their least and most expensive cars. With the group compare the advertising pitches for luxury cars with those for economy cars. How have the advertisers responded to needs? Created them?

What Do You See? What influence will societal values have on the technology of the future? Ask a panel consisting of a businessman, government representative, and worker to discuss this question. What trends do they see? How might they affect future products? Have they been wrong before in making such predictions? What causes their forecasts to be invalid?

Form and Function. Have the group debate this issue: The functionalist ethic still determines trends in American society. Consider: architecture (energy-conserving vs. decorative), household appliances and gadgets, furniture, automotive design, etc.

My Mother the Car. The film *Power and Wheels: The Automobile in Modern American Life* can motivate an intriguing discussion about the feelings of members of the group towards their cars, the "indispensability" of cars, their place in the economy.

7 Technology, Population, and Resources

"In the next four decades human beings will doubtlessly strain every nerve to support an ever larger population. If so, it will demonstrate that the species is tool-smart but goal-stupid, for no purpose is served by adding more people to an overcrowded planet." Kingsley Davis

Risk-benefit analysis is an attempt to place a monetary value on a human life. Its justification is that it is better to be objective than subjective in setting government priorities. The National Highway Traffic Safety Administration estimates the value of a life at $287,175.

Background

From the Courses by Newspaper Reader

• See "The Migrations of Human Populations" by Kingsley Davis; "The Food-People Problem" by Neal F. Jensen; "Intermediate Technology" by Wilson Clark.

From Popular Periodicals

• In "The Perversion of Science and Technology: An Indictment," Rajni Kothari and Saul Mendlovitz, co-directors of the World Order Models Project, attack the practices of science and technology used by multinational corporations and powerful industrial countries. They call for alternative modes for science and technology with a commitment to human rights and the betterment of human material conditions. (*Current*, October, 1978, pages 54–58)

• The May 26, 1978 issue of *Science* is devoted to health issues. Of interest to those involved in the *Connections: Technology and Change* program is "Nutrition, Population, and Health: Some Implications for Policy," which discusses how technology has affected birth rates, biological and behavioral factors affecting health and nutrition, and government policy-making concerning health. (Beverly Winikoff, "Nutrition, Population, and Health: Some Implications for Policy," *Science*, May 26, 1978, pages 895–901)

• World Bank President Robert S. McNamara examines the problem of overpopulation and what can be done about it in "How to Defuse the Population Bomb." (*Time*, October 24, 1977, pages 93–94)

• Charles F. Westhoff gives some tentative answers to questions about possible responses of industrialized countries to a decrease in population in "Marriage and Fertility in the Developed Countries." (*Scientific American*, December, 1978, pages 51–57)

• Paul R. Ehrlich and Anne H. Ehrlich discuss why their prediction of a birth-rate increase in the early 1970s was proven wrong in "What Happened to the Population Bomb?" Still, population will rise to about 6.2 billion in the world by 2000, they say, unless something is done. (*Human Nature*, January, 1979, pages 88–92)

Books to Review

• In *The Population Bomb*, written in the late 1960s, Paul R. Ehrlich argues that the root of the environmental crisis and the world food problem is too many people, and calls for radical measures to limit population growth. (New York: Ballantine, 1968)

• Will there be enough food for the world's people? Only if large corporate interests return control of food production to the people and ensure that it is properly distributed on a world-wide basis, say Frances Moore Lappé and Joseph Collins (with Cary Fowler) in *Food First: Beyond the Myth of Scarcity*. (Boston: Houghton Mifflin, 1977)

Suggested Discussion Questions

• What have modern agricultural practices done to the land? Are negative effects inevitable? Is it possible to increase productivity per acre without doing harm to the soil?

• What does crowding do to human nature? To our ideas about the value of human life? In what ways can crowded cities reduce the alienation felt by people who live in them?

• What are some of the ethical problems raised by advances in medicine that prolong human life? Consider the effects on developed and undeveloped nations. How do people in other cultures treat old people who can no longer function? What are possible (and humane) solutions to the problems created by an increasingly larger proportion of the aged in the population?

• What have been some of the unforeseen effects of antibiotics? Pesticides? Will microorganisms outlast more complicated forms of life—like human beings? Why?

Program Suggestions and Resources

Five Score Years and Ten. What if the human life span could be extended another forty years so that the average person would live to 110? How would this

affect world population, even if there weren't an increase in the birth rate? Have the group develop scenarios based on the impact of such a lengthening of the life span: The world in 20 years, in 30 years, in 50 years.

Eyewitness to American Aid. Members of the Peace Corps have seen first-hand the results obtained through help extended by the United States to people in developing countries. Invite one or more people who were in the Peace Corps (or a speaker from AID) to discuss experiences with the export of American technology and its effect on the individuals they worked with. Act as interviewer or select a member of the group to play the role.

Doctors or Garbage Men. It has been said that better sanitation has had more to do with extending human life than have advances in medicine. Invite a physician and a historian or sociologist to discuss this question.

Less Steak or Fewer Children? Show the film *Sorry, No Vacancy*. After a discussion of the film, involve the group in a debate about which is the better solution to the population crisis: reducing the birth rate or reducing average consumption.

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8 Incentives for Innovation: Technology and the Economy

"Our history shows that technology is an extremely versatile force and that it is highly responsive to changes in incentives and rewards. It should not be beyond our ingenuity to utilize the incentives of the marketplace to develop new technologies that will deal much more effectively with such current concerns as environment and energy." Nathan Rosenberg

In 1978, at least two cities considered making contracts with Earthworms, Inc., a company that produces waste-conversion plants where earthworms would eat garbage, sludge, and industrial waste. Such facilities would prevent contamination of ground water, recover natural resources, and provide a valuable byproduct—worm castings (manure). Moreover, they are economically feasible.

Background

From the Courses by Newspaper Reader

• See "Economic Growth, Technology, and Society" by Nathan Rosenberg; "Growth versus the Quality of Life" by J. Alan Wagar; "The Frugality Phenomenon" by Carter Henderson.

From Popular Periodicals

• Although the visions of the great economists Smith, Marx, and Malthus are mutually contradictory, each today has his adherents. In a 1978 magazine article, James H. Weaver and John D. Wisman examine the trends, problems, and future of our modern technological world (capitalist as well as communist, industrialized as well as developing) in the light of the theories of the three men. ("Smith, Marx, and Malthus—Ghosts Who Haunt Our Future: Three Economic Visions of Tomorrow's World," *The Futurist*, April, 1978, pages 93–104)

• Some business people see Big Business tied like Gulliver in Lilliputian threads of government regulations, and so kept immobile. Many environmentalists and government officials are also leery of regulatory laws. Neil Orloff suggests master plans and cooperation between business and government to solve environmental problems without straitjacketing technology. (Neil Orloff, "Payoff for Business Initiative on the Environment," *Harvard Business Review*, November-December, 1977, pages 8–12)

• The long-term trend in capitalist countries may be toward the free communication of goods—a trend reinforced by new technology, particularly in communications, according to Burnham P. Beckwith. ("Free! Free! Free! The Priceless World of Tomorrow," *The Futurist*, October, 1978, pages 307–312)

• How does technological innovation affect economic cycles? This question and others are discussed in an article in *U.S. News and World Report*. ("Why an Old Theory of Economic Ups and Downs Worries the West," *U.S. News and World Report*, November 6, 1978, pages 82–83)

• West German economists discuss the impact of technology and global interdependence on economic theory. (Karl Heinz Kelps, Rudolf Hickel, Karl Schiller, "Avoiding Recessions: Is Keynesianism Dead?" *Atlas*, March, 1979, pages 28–30)

Books to Review

• In *America by Design: Science, Technology, and the Rise of Corporate Capitalism*, David F. Noble advances the thesis that an alliance between scientific

and engineering educational institutions and corporations has produced a managerial elite that has taken control of the American economy. (New York: Alfred A. Knopf, Inc., 1977)

• The controversial and popular book by E. F. Schumacher—*Small Is Beautiful: Economics As If People Mattered*—argues that large-scale technology, destructive of nature and humans, lies at the root of three crises: pollution, resource scarcity, and human discontent. It advocates smaller and more appropriate technologies. (New York: Harper & Row Publishers, 1973)

Suggested Discussion Questions

• Do you agree with Marx and Engels that the rise of bourgeois institutions was a primary cause for the explosion of technological productivity in the early 1800s? Is it possible for a bourgeoisie to develop in a technologically backward nation? Might this happen in the Middle East? How?

• Is a profit system necessary for efficient development of technology? How might a non-capitalist nation encourage technological advances?

• The capitalist system has limitations in terms of technology development: for example, it is not always profitable for a company to risk capital on long-term research and development of a product that might not, in the end, prove to be feasible. How has government stepped in to cover this risk factor? What are some possible drawbacks of such government participation?

• The profit motive sometimes leads to innovations that have negative effects on the environment and on the safety and health of workers and consumers (e.g., air and water pollution from industrial plants, destruction of the ozone layer by fluorocarbons in aerosol cans). How can these negative effects be combatted without unduly slowing down the growth of technology?

Program Suggestions and Resources

Ad Analysis. If possible, videotape a television commercial by a company involved in technological research, then show it to the group. (If this can't be done, you might consider reproducing copies of a magazine advertisement on a similar subject.) How does the ad romanticize technology? What is it trying to say? What are the advantages of the research and development the company points to? What questions, if any, is the company avoiding?

More Butter, More Broccoli, More Steaks. What is being done technologically to increase crop yields and farming efficiency? What are the long-term effects of such practices? (For example, how do they affect small farmers?) How are these effects determined? Invite someone from the local agricultural experiment station to discuss such questions with the group. Include in the discussion information about government links with farmers and universities and the necessity for much current research to be done by government rather than the private sector. Show the film *The Farmer in a Changing America* as part of your program.

Taxing the Answer? In Los Angeles, a plan has been developed that would allow big industries to locate their plants in the city if they pay the cost of cleaning up more pollution than they cause. What other plans are afoot to solve economic problems of technology? Invite a panel consisting of businessmen, an economist, and a government official (perhaps from the Environmental Protection Agency) to discuss such plans and their potential effects.

Two Scenarios. Divide the group into two sections, one to develop a narrative scenario based on the proposition that technology must be slowed, and the other to develop a scenario based on the proposition that it must be left free. Time frame: now through 2000.

9 Science and Technology: A Growing Partnership

"In the 20th century, scientists and technologists have formed a partnership in applied science." R. P. Multhauf

The "eminent mechanics" Multhauf mentions in his CbN article still exist—and work and invent. Floyd Wallace, a Michigan chemistry teacher, devised a furnace that produced gasoline higher in octane than aviation gas from leaves, table scraps, and other garbage. Francis Goettsch, a former rancher, invented an electric steer to practice roping—patent pending. John Hoke, nicknamed "Col. Clink" by his National Park Service colleagues, invented, among other things, an air-conditioned pith helmet, cooled by a solar-cell-operated miniature fan; he drives an electric car, wants to install a park on the roof of the Interior Department building.

Background

From the Courses by Newspaper Reader

• See "Little Science, Big Science" by Derek J. de Solla Price; "How the Transistor Emerged" by Charles Weiner; "Social Problems of Industrialized Science" by Jerome R. Ravetz.

From Popular Periodicals

• On the one hand taxpayers resist paying for technological research and development, while on the other scientists argue that it is necessary. The situation is reviewed by William D. Carey in "Science in the Political Economy." (*Science*, November 17, 1978, page 703)

• What image does the scientist have in the United States? Patricia A. Morgan suggests some answers in "But I Wouldn't Want My Daughter to Marry One." (*Chemistry*, October, 1978, page 2)

• Current issues relating to science and technology were presented in an address by L. P. Benson on May 18, 1978. (L. P. Benson, "Science and Technology: Their Interaction with Foreign Policy," *Department of State Bulletin*, October, 1978, page 54)

• Defining science as "know-why" and technology as "know-how," historian Melvin Kranzberg claims that scientists and engineers are more alike than they imagine but there are still two areas of distinction between science and technology: (1) a cultural distinction based in differing self-images; (2) an operational distinction in that scientists, thinking themselves above and in control of engineers, often call them "cultural barbarians" or "plumbers." He points to the growing exercise of control of technology and science by society and calls for education of the public, of science-technology students, and of scientists and technologists themselves. (Melvin Kranzberg, "The Science-Technology Complex," *Society*, January-February, 1978, pages 54–55)

• Is the United States losing momentum in the technological race? Jean Gimpel, a social historian, says yes. He provides historical background to show that all technological societies reach plateaus—e.g., Great Britain and China. In his article, he suggests reforms such as the creation of an Office of National Economic Planning, more cooperation between government and industry, greater and closer international exchange of information. (Jean Gimpel, "The Greying of America," *National Review*, November 26, 1976, pages 1284–1288)

Books to Review

• What are the social relations of science and technology? In *Force of Knowledge: The Scientific Dimension of Society*, John Ziman explores this question and introduces the reader to a wide range of related issues. (Cambridge, Mass.: The University Press, 1976)

• The general problems of growth and size of the scientific enterprise have tremendous effects on contemporary society, which are analyzed by Derek J. de Solla Price in *Little Science, Big Science*. (New York: Columbia University Press, 1963)

Suggested Discussion Questions

• Why has the technologist been honored more in the United States than in other parts of the world? Is this still true today? Why? Who are the "eminent mechanics" of our time? Do you agree that modern technologists need advanced degrees? Why?

• The scientist-inventor, on the surface a good idea, was a dud, according to Multhauf. What are some of the reasons this might have been true? What are the characteristics of the scientist? The inventor?

• What factors have contributed to our current disenchantment with science and technology? Is the disenchantment deserved? How might science and technology get back into society's good graces?

Program Suggestions and Resources

Toward a Definition. How can science and technology be distinguished from each other? With the

group, develop definitions for the two disciplines that are mutually exclusive.

Out of Favor/Back in Favor. How do scientists and technologists feel about society's disenchantment with their fields? Convene a panel of scientists and technologists to discuss this issue. If possible, invite people from the commercial world as well as academia. What, in their opinion, lies behind lessening belief in the "magic" of science/technology? How has it affected them in terms of government funding, dollars for research and development? Do they think the climate will change? When and how?

To the Museum. If you have not already done so, it might be a good time to visit a museum of science and industry in order to view the accomplishments of American scientists and technologists.

Scenario of a Relationship. With the group, develop a scenario of the future relationship between science and technology, perhaps according to the possible events of the next 30 years. Consider: military research and development, space exploration, agricultural technology, relationships among nations, the computer revolution. How might the demands of society, faced with the disadvantages of technology, force growing involvement by scientists? How might the human need for practical technological devices pull scientists away from "ivory tower" theorizing? How might the absence of such theorizing slow the advance of scientific thought and accomplishment in the long run? You might want to call on some experts from a local community college—e.g., an engineer, political scientist, futurist—to help in this activity.

The Wiz. The film *The Wizard Who Spat on the Floor* can serve as an excellent springboard for a discussion of what makes inventors tick. Ask the question, "Might Edison have been a scientist or technologist today? Why?"

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10 The Imperatives of Engineering

"Fewer than one in a hundred Americans are engineers, but because they are decision makers, engineers are far more influential than their numbers would suggest." Eugene S. Ferguson

In 1835, John Childe, an engineer, was standing on a cliff overlooking a wild panorama of mountainous country which he was surveying for a railroad. "What a place for engineering!" he exclaimed.

Background

From the Courses by Newspaper Reader

- See "Engineering the Household" by Siegfried Giedion; "The 'Industrial Revolution' in the Home" by Ruth Schwartz Cowan; "Unsafe at Any Speed" by Ralph Nader.

From Popular Periodicals

- In spite of recruitment by engineering schools and corporations, only one per cent of the engineers in the United States are women. Why do women shy away from the profession? In trying to uncover the answers, Samuel C. Florman attempts a characterization of the engineering personality. He interviews Carl Frey, executive director of the Engineers Joint Council, who says that women "don't see engineers as the ones who have the say in our society. And, let's face it, to a great extent, they're right." If so, does the technological elite that intellectuals complain about really exist? (Samuel C. Florman, "Engineering and the Female Mind," *Harper's Magazine*, February, 1978, pages 57–63)

- The inventiveness of American engineers and technologists has helped the United States develop the highest standard of living in the world, according to *Time* magazine. ("American Ingenuity: Still Going Strong," *Time*, July 5, 1976, pages 71–72)

- Michael Harrington criticizes the engineered world of the Magic Kingdom, a corporate and technological utopia twice the size of Manhattan, in "To the Disney Station." (*Harper's Magazine*, January, 1979, pages 35–44, 86)

- Colleges are now teaching prospective engineers management skills, including how to solve problems involving human beings. ("Teaching Engineers to Manage," *Business Week*, November 6, 1978, pages 197–198)

- From an emphasis on pure technology, we as a society have shifted to concentration on understanding the human system in which technology exists. How are people affected by new technological advances? How can we conserve our resources without giving up technological comforts? The result of these concerns has been more government research money going to

"soft" sciences and a drop in patent applications since 1971. (Jack McWethy, "Gadgets to People: Science Shifts Focus," *U.S. News and World Report*, November 8, 1976, page 54)

Books to Review

• About 175 years ago, craftsmen in New York wanted to solve a simple engineering problem: building a lock to connect a creek with a river. It took years of effort, consultation with European experts, and much trial-and-error before they achieved their goal. Today engineers work with sophisticated tools in sophisticated laboratories, but problems still exist. Elting E. Morison is optimistic about technology—he thinks we can "build the technological firmament that will really fit us." (Elting E. Morison, *From Know-how to Nowhere*. New York: Basic Books, Inc., 1974)

• *Machines* traces the history of machines through the Age of Steam, assembly lines, the internal combustion engine, modern technological devices, automation. Are engineers "designing people out of the machine process"? What human problems are caused by automation? (Robert O'Brien and the Editors of LIFE, *Machines*. New York: Time Incorporated, 1964)

Suggested Discussion Questions

• Do you agree that the human is possessed of an insatiable curiosity that cannot be quelled? If so, how can we accept putting a lid on potentially dangerous technology? Could our interest in technology be a mere aberration peculiar to our times?

• What characteristics that make people want to be engineers work against their interest in social problems and their proficiency in solving them?

Program Suggestions and Resources

Design Seminar. Split the class into smaller groups, each to work on a redesign of a common device. The criteria: to improve the device to fit human characteristics and needs better. Possible devices: vacuum cleaner, typewriter, calculator, elevator, computer terminal, automobile.

Where's the Crystal Ball? Debate the question: Is the engineer responsible for the dangers and disadvantages of what he designs? Can he foretell such effects? Should he?

The Engineer Answers. Invite an engineer to speak about questions raised in Ferguson's article. Does the engineer agree with Ferguson's imperatives? His analysis of the engineering personality? Allow time for the class to ask questions and present opinions.

The Education System Answers. Invite someone from the Engineering Department of a local college to discuss questions in Ferguson's article. Does he agree with Ferguson's imperatives? If so, what is the education system doing to prepare engineers to deal with social problems?

A Panel of Experts. Convene a panel consisting of an engineer, a representative of a consumer organization, a businessman, a homemaker, a government official, and a teacher of engineering to discuss how engineers can better meet social imperatives.

Tons of Garbage. Watching *The 3rd Pollution*, which explores several alternatives for solving the solid-waste problem, can provide the basis for a lively discussion. Proponents of various methods outlined in the film can give arguments to back up their positions against others in the group.

11 Wars: Hot and Cold

"Throughout history, political and military leaders on the one hand have used science and technology to further their ends, and scientists and engineers on the other have exploited the special interests of the state to advance their own goals." Herbert F. York and G. Allen Greb

When Robert Fulton presented his idea for the steamboat to Napoleon Bonaparte, the French military genius rejected it as impractical. Some strategists say that if Bonaparte had listened more carefully and accepted the idea, he could have used steamships to invade England. And who knows how *that* would have shifted the course of history?

Background

From the Courses by Newspaper Reader

• See "Letter to President Roosevelt" by Albert Einstein; "Nuclear Weapons Development" by Andrei D. Sakharov; "Strategic Reconnaissance" by Herbert F. York and G. Allen Greb.

From Popular Periodicals

• In 1944 Rumanian oil reserves were bombed out by the Allies, and the Nazis, facing a gasoline shortage for tanks and planes, put into practice their plan for making gasoline from coal. In 1975, Professor Richard Wainerdi, from the Chemical Engineering Department at Texas A & M, and historian Arnold Krammer unearthed 300,000 documents concerning Nazi coal-to-gas technology, which may aid us in solving energy problems of the 1970s and 1980s. ("Recycling Nazi Secrets," *Time*, April 18, 1977, page 58)

• What are the prospects for world peace in view of growing arsenals of modern weapons, overpopulation, and poor global economy? Jerry Richardson looks at some answers in "The Outlook for World Peace and Prosperity." (*The Futurist*, December, 1978, pages 387–394)

• A program for decreasing U.S. military forces without undermining our security is described in an article in *Scientific American*. (Philip Morrison and Paul F. Walker, "A New Strategy for Military Spending," *Scientific American*, October, 1978, pages 48–61)

• Citizens in Rocky Flats, Colorado, are protesting the building of thermonuclear devices. Edward Abbey tells their story in "One Man's Nuclear War." (*Harper's Magazine*, March, 1979, pages 8–18)

• New weapons—laser-guided missiles, heat-seekers, fuel-air explosives (FAE)—will change the structure of the fighting unit and alter the balance of power in the world, according to a *National Review* article. ("New Weapons II," *National Review*, August 19, 1977, page 77)

Books to Review

• In October, 1945, physicist J. Robert Oppenheimer resigned as director of the Los Alamos Laboratory with the statement, "I'm not an armaments manufacturer." Intimately involved with government as a science adviser to the Atomic Energy Commission in the postwar years, Oppenheimer was accused of disloyalty to the United States and his security clearance was revoked in the early 1950s. His story illustrates the potential for tragedy as the scientist, enmeshed in politics and clinging to a moral point of view, meets head on the forces of government that hold an opposite moral view. (Denise Royal, *The Story of J. Robert Oppenheimer*. New York: St. Martin's Press, 1969)

• The space program, a spinoff from a para-military race with the USSR, has yielded technological advances valuable on a peacetime Earth. Among them: communications satellites, cardiac pacemakers, grooved highways, powerful solar cells, new railroad car designs, the Rogallo wing, sophisticated computer programs. (*Spinoff 1976*. Washington, D.C.: National Aeronautics and Space Administration, 1976)

Suggested Discussion Questions

• What factors caused mustard gas and biological warfare to be outlawed? Why haven't nuclear weapons, smart bombs, laser death rays, and napalm been outlawed also?

• How have communications changed the course of wars and public opinion toward them? Examples: Edward R. Murrow's rooftop broadcasts from besieged London in World War II, the televising of the Vietnam War.

• By eliminating hand-to-hand combat through the use of military technology, we have depersonalized warfare. Will technology put itself out of business in the military sphere by lessening the appeal of killing?

• How are universities, scientists and technologists, and government involved in military planning? How

much influence should each sector have? If technologists are going to have a say in military matters, should they be educated in non-technical subjects, too? What kinds of concerns should they be made aware of?

Program Suggestions and Resources

War Game. Using other games simulating war (chess, for instance) as examples, have the group or several smaller groups work together to develop a board game based on modern warfare. Elements to consider are: assigning responsibilities to various "pieces" (groups) such as the university, the think tank, the government agency; determining the "values" (killing capacities) of weapons; devising wild cards describing certain events (e.g., one side's secret and successful development of a powerful weapon); ordering the probabilities of the success of specific strategies. Questions: Is the war linear (enemies facing each other) or non-linear (guerrilla warfare in which the enemy may come from any direction)? What are possible outcomes—averting war, a draw, winning, losing—and what causes them?

What Wins Wars? There are those who hold that technological superiority is the one overriding factor in determining the outcome of a war. They say that nothing means more—not numerical superiority, not clever strategy, not patriotic spirit. Invite two historians to debate this question: Is technological superiority more important than anything else in deciding the victor in a war?

Alternatives. After showing the film *A Thousand Cranes: The Children of Hiroshima*, have an anthropologist speak to the group about the theory that man has an aggressive instinct that lies behind his constant involvement in war. If, indeed, such an instinct does exist, how might it be diverted into other channels through technology and other means? Discuss such alternatives to war.

The Military Speaks Up. Invite a representative from a local military installation to speak to the group about technology in warfare. How has it affected training practices? Recruitment? How many weapons need be stockpiled to avert war? What is the interaction with government agencies, universities, business?

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12 The Government's Role in Technological Change

"The amount of research and development that is urgently needed to lead and control technological innovation has gone up dramatically in the last decade."
A. Hunter Dupree

At the turn of the century, Brooklyn surveys were conducted in four different legal measurements of feet—the U.S. foot, the Bushwick foot, the Williamsburg foot, and the 26th-Ward foot. In 1901, the National Bureau of Standards was established to deal with such problems. Today, technology demands accurate measures. For example, the meter has been defined since 1960 by the wavelength of light emitted by the element krypton 86.

Background

From the Courses by Newspaper Reader

• See "Science and American Agriculture" by Reynold M. Wik; "Science and Government Agencies" by Carroll W. Pursell, Jr.; "Bursting Boilers and the Federal Power" by John G. Burke.

From Popular Periodicals

• Half of the agenda at the 1978 American Association for the Advancement of Science colloquium on the policy for research and development was devoted to university-government relationships. The other half was concerned with industrial research and development. What factors have caused the current static level of research and development in the United States? What measures has the U.S. government taken to correct this? ("The Federal Government and Innovation," *Science*, August 11, 1978, page 10)

• Cooperation between government and science/technology can produce a better climate of living, claims an article in *The Nation's Business*. ("Using Technology to Advance Human Progress," *The Nation's Business*, December, 1976, pages 20–24)

• "How are we to find more responsible ways to make sound public judgments on critical national issues such as the control of energy, science, and technology?" asks William J. McGill in "Controlling Science." (*Current*, April, 1978, pages 42–46)

• A sophisticated cable television system allowing viewer feedback has been installed in Columbus, Ohio. A vast amount of information about viewers who respond is stored in its computer, accessible to

government officials. Does this constitute an invasion of privacy? (John Wicklein, "Wired City, U.S.A.: The Charms and Dangers of Two-Way TV," *Atlantic*, February, 1979, pages 35–42)

• The transfer of American technology to developing countries has had some negative side effects—irrigation schemes that led to epidemics, industrialization responsible for city slums. At a meeting preliminary to the United Nations Conference on Science and Technology in 1979, William W. Winpisinger of the Machinists and Aerospace Workers union said, "It is time for the American worker to put his hand over his wallet. We don't have to cut our own throats by exporting American jobs," he argued. This report presents evidence that aiding developing countries with technology may work in the opposite way—to better the lot of the American worker. ("Technology Transfer: Toward a Redirection," *Science News*, November 27, 1976, page 342)

Books to Review

• During World War II, bitter enmity between two British scientists powerful in government—Sir Henry Tizard and F. A. Lindemann—often worked against the smooth operation of the war effort. From their story, C. P. Snow derives approaches for democratic societies to reduce the dangers of situations in which "cardinal choices have to be made by a handful of men: in secret; and, at least in legal form, by men who cannot have a firsthand knowledge of what those choices depend on or what those results may be." (C. P. Snow, *Science and Government*. Cambridge, Mass.: Harvard University Press, 1961)

• What is technopolis? It is where we live, some might say—a place where applied science is the ruling force. After years of research in seventeen countries, Nigel Calder asks: Who will bring the gigantic power of technology under control? His *dramatis personae:* "mugs" and "zealots," who hold opposing viewpoints on such issues as manned space flight, the automobile, monitoring devices, computers, drugs. Calder says that scientific knowledge itself must be mobilized to prevent its own destruction. (Nigel Calder, *Technopolis: Social Control of the Uses of Science*. New York: Simon and Schuster, 1969)

Suggested Discussion Questions

• How have our laws been reshaped by technology? Consider the effect on copyright law of copiers and videotape machines, on the invasion of privacy of bugging devices, on business law of computer crime.

• Should government make companies responsible for their products? If the government is not involved, how can the public be protected from defective and potentially dangerous products? What penalties should be involved? Is the corporate structure too protective of executives who knowingly release dangerous products? What has technology done to our concept of free enterprise?

• How have American attitudes toward machine-based agriculture, atomic energy, industrial waste, and air pollution changed in the last twenty years? Why is it necessary that government be involved in decisions involving control of such matters? What level of government—local, state, or federal—should exert most control?

• What should be the extent of government involvement in technology through universities, foundations, and industry?

Program Suggestions and Resources

The Lethal Embrace? Is once-necessary government financing of technological research a positive or negative force in present-day society? Debate the question. Invite an engineering professor and a political science professor to participate.

A Long Arm of Government. Almost every branch of government is in some way a sponsor of technological research. Invite one or more representatives of government agencies to speak about their current technological projects, the rationale for those projects, and the potential impact on society of their results.

Rules and Regulations. Many businessmen, especially those with small operations, chafe against government regulation. How many such regulations are necessary because of complex—or not-so-complex—technological advance? Bring together a panel of businessmen, a political science instructor from a local college, and a government representative to discuss the question.

Patent Pending. Invite an inventor or representative of the U.S. Patent Office to discuss the need for patents, their effect on research and development of new technological ideas, and difficulties and advantages of our patent system. You might begin the program by viewing the film *Patent Pending*.

13 The Mystery of Inventiveness

"In pure science, great discovery, especially if it has technological overtones, occasionally comes by accident or happy chance to researchers. . . . In engineering such luck is curiously rare. Inventors seem to have to work for everything they invent." Lynn White, Jr.

In 1978, the Institute of Electrical and Electronic Engineers sponsored the "Amazing Micro Mouse Maze Contest." Thousands of inventors competed to produce the electronic mouse with the highest I.Q. The *Christian Science Monitor* commented, ". . . the engineers should be given their heads to confirm the new adage that if you make a better mouse the world will beat a pathway to your door."

Background

From the Courses by Newspaper Reader

- See "The Act of Invention" by Lynn White, Jr.; "Economic Sources of Inventive Activity" by Jacob Schmookler; "The Mind's Eye: Nonverbal Thought in Technology" by Eugene S. Ferguson; "The Sources of Invention" by John Jewkes, David Sawers, and Richard Stillerman.

From Popular Periodicals

- The first spokesman for national science and technology in the United States may have been Thomas Jefferson, according to Hugo A. Meier, a history professor at Pennsylvania State University, in a Voice of America interview. Jefferson invented several practical devices: a dumbwaiter for bringing wine from cellar to drawing room, a six-pack case for wine, a mouldboard for a plow. Aware of European snobbery about American invention (not as purely elegant as science), he explained his mouldboard to Londoner Sir John Sinclair as combining "a theory which must satisfy the learned, with a practice intelligible to the most unlettered labourer" and therefore "acceptable to the most useful classes in society." ("Thomas Jefferson and the Growth of American Technology," *Intellect*, November, 1977, page 192)

- An article in *The Futurist* explores the ideas of Gilbert Kivenson, who maintains that "inventing can be taught." ("Learning How to Innovate," *The Futurist*, April, 1978, page 133)

- R. Buckminster Fuller, inventor of the fog gun and geodesic dome, among other things, left Harvard University during his freshman term and never went back. *Science Digest* carries an excerpt from A. V. Lord's biography of Fuller, *Pilot for Spaceship Earth*. (A. V. Lord, "The Leonardo of Our Age," *Science Digest*, November, 1978, pages 78–81)

- Why did Bank of America executive Alvin C. Rice resign from his job to join controversial inventor Edward Koppelman in the development of K-Fuel, a product, as yet unperfected, of bioconversion? ("The Koppelman Kaper," *Forbes*, October 16, 1978, page 130)

- *Popular Mechanics* has been published since 1902, a year before the Wright brothers successfully flew a plane at Kitty Hawk. To celebrate their 75th anniversary, the editors of the magazine asked twelve prominent Americans to identify key technological developments of the past and predict the future. Among them were Harold C. Urey, Peter C. Goldmark, Henry Ford II, Margaret Mead. In addition, the magazine included a retrospective of inventions from the photocopier to the ballpoint pen. ("Popular Mechanics Seventy-Fifth Anniversary," *Popular Mechanics*, January, 1977, pages 63–106)

Books to Review

- What processes and agonies did prominent inventors go through during their careers? Byron M. Vanderbilt takes a close look at six noted nineteenth-century inventors: Goodyear, Bell, Edison, Westinghouse, Acheson, and Nobel. (Byron M. Vanderbilt, *Inventing: How the Masters Did It*. Durham, N.C.: Moore Publishing Company, 1974)

- Who are the innovators? How do they create? *The Innovators* gives a detailed account of the processes of invention. (*Wall Street Journal* staff, *The Innovators*. Princeton, N.J.: Dow Jones Books, 1968)

Suggested Discussion Questions

- Are the devices that are invented the ones that people want and need? What is your opinion on this question? What specific instances reinforce your argument?

- What examples of the engineer's concern for human safety appear in technological innovations of today? Consider household appliances, transportation vehicles, gardening tools.

- Do you agree that too much awareness of past experience handicaps inventors? How does the design of a modern automobile show signs of its predecessors—earlier models, the horse-and-carriage? What other modern inventions reveal telltale signs of

their technological ancestors?

• Do you agree with Lynn White that "happy chance" does not come to inventors as easily as to "pure" scientists? What might be some of the reasons for this—if it is true?

Program Suggestions and Resources

Crazy Genius? Inventors are often stereotyped as impractical and wild-eyed geniuses tinkering away in garages—of course, not true. Most are highly educated, quite sane; most use highly sophisticated equipment. Invite an inventor to talk to the group about his career, his inventions, the processes he went through to create those inventions, how the field has changed since he began, what he foresees for the future.

Should the Lid Be Put on It? What will happen if the process of invention is more tightly controlled by the government? Ask a panel consisting of a political science professor, an economics professor, a businessman in the electronics industry, and someone from the United States Patent Office to discuss this question. If time allows, have the group use the information to develop three narrative scenarios of what will happen to the world in 50 years if: (1) invention is tightly controlled by government; (2) invention is loosely controlled by government; (3) invention is not controlled at all by government.

Inventing an Invention. Is the technological process of invention sufficiently free of control by society that it operates somewhat at random? What inventions need to be invented? Ask the group to pinpoint some devices not yet in existence (at least in needed form), then describe them in writing or drawing. Devices might be variations (a new kind of vacuum cleaner, for example). The group might feel more comfortable splitting up into smaller groups of five or six for this activity. When they are finished, invite comment on the processes they went through in inventing the devices.

Out-of-Bounds to Idea Thieves. Invite a representative from the United States Patent Office to discuss the process of patenting inventions, to give a short history of the office, and to venture an opinion on the growth trends of invention in the United States.

What Makes Them Tick? Show the film *Koestler on Creativity* and follow it with a discussion by a panel consisting of a psychologist, an artist, a writer, and an inventor on the act of creation. Is creativity the same in all fields or are there differences?

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14 Technology and the Seamless Web: Ethical Dilemmas

"The dilemma we face is that of how to enjoy the fruits of technology without losing our true freedom, our inner strength. Can technology feed this strength or does it simply dissolve it?" Bertram Morris

Technology can enhance the arts, as well as make war more lethal and damage the environment. Sophisticated computer systems are being used by musicians and composers at conservatories and universities to conduct experiments with sound. Roger Reynolds recently composed a piece called "... The Serpent-Snapping Eye" (taken from a line in Herman Melville's *Moby Dick*), which combines sounds generated by a Stanford University computer with trumpet and percussion: a wedding of technology and art.

Background

From the Courses by Newspaper Reader

• See "Democracy at the Grass Roots" by David E. Lilienthal; "Freedom and Direction" by James C. Wallace; "The Industrial Way of Life" by C. E. Ayres.

From Popular Periodicals

• The lifeboat metaphor—who gets thrown from the lifeboat when one must drown or all will die—has been applied by some to the world as a whole. Which nation shall "die" so the rest shall live? Richard J. Barnet explores the myth of scarcity, the lessened value of human life, the decreased need for labor because of automation. Is it possible for developed nations to exploit less technologically advanced countries for raw materials while guarding against terrorism, epidemics, and economic collapse? Barnet calls for a return to respect for human life and dignity. ("No Room in the Lifeboats," *New York Times Magazine*, April 16, 1978, pages 32–38)

• The technology of converting wastes to energy is growing apace. Recent developments are discussed in "Moving to Garbage Power." (*Time*, January 9, 1978, page 46)

• Technology and the arts come together in electronic music. According to *Forbes* magazine, 40 percent of the musical instruments sold in the United States are electronic. ("Sharps and Flats in an Old

Song," *Forbes*, January 22, 1979, pages 46–47)

• In discussing the Age of Compulsory Equality, Tom Bethell analyzes possible effects of our egalitarian principles on scientific endeavors, particularly genetic research. (Tom Bethell, "Burning Darwin to Save Marx," *Harper's Magazine*, December, 1978, pages 31–38, 91–92)

• Huge dams built to bring the benefits of modern technology to the developing world have also brought disease, according to Donald Heyneman. ("Dams and Disease," *Human Nature*, January, 1979, pages 50–57)

• The Gaia hypothesis, developed by James Lovelock and Lynn Margulis, is a view of the biosphere in which it, as a whole, regulates aspects of the environment. As an example: some ecologists view with considerable alarm the possible long-range effects of carbon dioxide released into the atmosphere from industrial chimneys. It could heat the atmosphere enough to cause radical changes in climatological patterns. Yet geologist Fred MacKenzie points out that the byproducts of mechanized technological agriculture may balance the carbon dioxide. It appears that nature will not allow humans to destroy the earth's ecology. Nevertheless the author is not optimistic about unchecked, unmonitored abuse of our planet. (Fred Hapgood, "Gaia: The Harmony of Our Sphere," *Atlantic*, December, 1977, pages 100–104)

Books to Review

• Religion and religious values are still important in our technological world, according to Ian G. Barbour. In *Science and Secularity: The Ethics of Technology*, he argues that religion can be used to direct technology toward human ends. (New York: Harper & Row, 1970)

• The classic Greek tragedy *Prometheus Bound* (Aeschylus) conveys several modern themes: the arrogance of man in transforming nature into artifacts; the indulgence of self-will to the exclusion of wise counsel; unrestrained power contrasted with the life-giving arts. (Cambridge, Mass.: The University Press, 1932)

• In *Toward a Reasonable Society: The Values of Industrial Civilization*, Clarence E. Ayres argues that anything promoting life activities is good and that in modern society science and technology fulfill this function. (Austin: University of Texas Press, 1961)

Suggested Discussion Questions

• Do you agree that we are slaves to technology, "tools of our tools"? In what way? Is this inevitable? What is the effect on the individual of mass-society caused by technology? On nature?

• Is it possible for the United States and other industrial nations to remain high-technology societies without contributing to poverty, famine, and disease in developing nations? Should our freedom be limited to provide justice in the world? How?

Program Suggestions and Resources

A Promethean World. Invite a humanities professor to a group meeting for a reading of sections of *Prometheus Bound* that pertain to the questions raised by Morris' article. In a discussion following the reading, consider the following: What problems were created by technology in the time of the ancient Greeks? Today? In what ways are the problems forever the same?

The Fruits of Technology: Bitter or Sweet? Can we enjoy the fruits of technology without losing our freedom? Have the group debate this question. Factors: the technological war machine; pollution of the planet; the communications revolution; computer prying; sophisticated transportation systems; increased leisure time. Follow with a showing and discussion of the film *Bruce and His Things*.

Stone to Missile; Hand-ax to Power Saw. How do the tools of primitive humans reflect their needs, affect their lives, alter their view of themselves and the environment? And how do the tools of a high-technology society affect the people in it in similar ways? Invite an anthropologist to talk to the group about these questions. Perhaps a display of primitive and modern tools could be arranged.

Songs Sung by the Computer. Invite a musician who uses electronic instruments to play for the group and discuss the impact of technology on his art. If possible, have the same composition played on both an old-fashioned and an electric instrument (e.g., guitar). How has technology affected the music profession through television, recordings, tape recordings, transportation, marketing, etc.?

15 Assessing and Directing Technology

"Although Technology Assessment does not yet have all the answers, it conforms to one law of common sense: Think about what you are doing before you do it." Melvin Kranzberg

One solution to our energy problem is to build a giant satellite/reflector to collect solar energy, convert it to electricity, and beam it in the form of microwaves down to Earth. Critics of microwave technology talk of electromagnetic radiation pollution, which may increase incidence of heart disease and cancer. Who's right?

Background

From the Courses by Newspaper Reader

• See "The Futility and Dangers of Technology Assessment" by Peter F. Drucker; "Technology As Legislation" by Langdon Winner; "Technology Assessment in Retrospect" by Harvey Brooks.

From Popular Periodicals

• "Technology and Technology Assessment," the fall 1978 issue of *National Forum*, contains a far-ranging discussion of the controversies in this field. (See p. 9, above.)

• The United States Congress has increased its efforts to determine the long-term effects of its legislation relating to technology. In his article "How Congress Is Exploring the Future," Ren Renfro, a futures researcher, describes these attempts to forecast technological consequences. (*The Futurist*, April, 1978, pages 105–112)

• Has the human race come to feel in league with magic? *Harper's* editor Lewis H. Lapham wonders if we will look like "children playing with deadly toys" (technological ones) to people in the thirtieth century. (*Harper's Magazine*, February, 1978, pages 20–22)

• How optimistic can we be about our future, in view of technology and its effect on the world? (Barry B. Hughes and Mihajlo D. Mesarovic, "Testing the Hudson Institute Scenarios: Is Their Optimism Justified?" *World Future Society Bulletin*, November-December, 1978, pages 1–15)

• Canada is conducting an inquiry into the social, economic, and environmental impacts of the Mackenzie Valley pipeline. D. J. Gamble reports on how the inquiry operates. ("The Berger Inquiry: An Impact Assessment Process," *Science*, March 3, 1978, pages 946–951)

• We are "locked into a dynamic system of global economics" that is based on technological change, says Frank Press, director of the Office of Science and Technology Policy, in "Science and Technology: The Road Ahead." (*Science*, May, 1978, page 737)

Books to Review

• What are the alternatives? In *Tools for Conviviality*, Ivan Illich writes a critique of modern industrial society. He offers an alternative course for a future society not dominated by industry, one in which technology is harnessed and employed for the benefit of mankind. (New York: Perennial Library, 1973)

• *Technology: Processes of Assessment and Choice* is a basic report by the National Academy of Sciences to the Congress underlying the decision to establish an Office of Technology Assessment. (Washington, D.C.: U.S. Government Printing Office, 1969)

Suggested Discussion Questions

• In his article, Melvin Kranzberg discusses the second-order and third-order impacts of technological innovations, e.g., a first-order effect of the automobile is individual transportation, while secondary effects include pollution and reliance on imported oil. What are some secondary effects of the computer?

• What might be some secondary effects of an energy breakthrough—a technological innovation through which solar energy could be supplied in large amounts, for example? Consider energy networks, the economy, jobs, environment.

• What will happen if technology assessment becomes "Technology Arrestment"? Do you think such an occurrence is possible? If so, how would your life be affected?

• What trade-offs do you feel are necessary in response to changes in energy and materials technologies?

• What are the values people give lip-service to today? What values do they really believe in? How will this affect our future control of technology?

Program Suggestions and Resources

Dig Up the Time Capsule. If you tape-recorded responses to questions about technology in connection with your first meeting, play some of them back to the group. Then ask: Would your answers to these questions be different now? In what ways? Why?

Backtracking to the Future. Show the film *Things to Come*, made in 1936. After the film is over, discuss how accurately it predicted the future and ask: How might scientists and technology plan for the rebuilding of the world after a nuclear war in the 1980s? How do our predictions of the world in 2036 differ from those of the film-makers? Why?

King Midas of 1979. What we touch has unforeseen effects on us. Horror stories about long-term consequences of asbestos inhalation, fires from plastic foam, possible cancer from food additives appear in newspapers and magazines constantly. What is government doing to protect us? Consumer groups? Manufacturers? Invite a panel of a representative from government (perhaps the Consumer Products Safety Commission), a consumer group, and a manufacturer to discuss this question and its effects on the economy as well as on our health.

What Are the Trade-Offs? Have the group debate the question of whether it is justified for a minority, such as coal miners, to suffer (even at high pay) for the majority.

SECTION THREE

Resources

This section has three parts. Part One is a descriptive list, in alphabetical order, of national organizations, foundations, agencies, and groups that focus on topics directly related to technology and change. Part Two is a state-by-state list of museums with displays on technology and industry. Part Three is a list of State Humanities Offices.

Part One: List of Organizations, Agencies, and Groups

The following groups offer (free or for sale) materials such as handouts, pamphlets, books, and films, and they may be sources for speakers. Don't forget local sources: libraries, businesses, factories, unions, and ad hoc organizations formed around a specific issue.

Agency for International Development
Office of Public Affairs
Washington, DC 20523

With headquarters in the Department of State in Washington, the Agency for International Development (AID) administers most of the foreign economic assistance programs of the U.S. government. Among its interests are increasing food production through better technology, population planning, health and nutrition, and education and human resources development.

To arrange for a speaker, write to Wade B. Fleetwood, Speakers/Conferences Officer at the above address. Include enough information about your meeting to facilitate the choice of an appropriate representative.

Publications (free) may be obtained by writing to AID and include:

AID's Challenge in an Interdependent World. This 36-page booklet contains information on AID's activities and describes new agricultural technologies and rural electrification efforts. (DN-RIA-119 90/178)

Why Foreign Aid? An address by John J. Gilligan, Administrator of AID, discusses the effects of deforestation and poor fishing practices.

Development Issues: U.S. Actions Affecting the Development of Low-Income Countries. The Third Annual Report of The President Transmitted to The Congress, April 1978. This book contains information about technology, population, and agriculture.

The AID magazine *Agenda,* which often contains articles about technology and its effect on the Third World, is available free to those who ask to be placed on the AID mailing list.

Films, available on free loan, may be obtained through Association Films at regional offices (contact AID for listing) or purchased at cost by contacting Carl Purcell, Supervisor of Visual Information, at the above address. Examples:

Pakistan—Land of Promise, 14½ minutes. A documentary film dealing with the utilization of water for power and agriculture, *Pakistan—Land of Promise* focuses on the huge Tarbella Dam and the Indus Basin.

Nicaragua: Planting the Seeds of Change, 27 minutes. The film shows problems faced by the *campesinos* and explains INVIERNO, the rural development program designed to help them through offering farm credit, technical agricultural assistance, and social services.

Haiti: Mountains to Cross, 14½ minutes. Self-help efforts of the Haitians are augmented by CARE, the American government, and other countries. The problems: overpopulation, deforestation, soil erosion, primitive agriculture, 90 percent illiteracy. Some of the technological solutions: irrigation, road improvement, school construction, agricultural technology.

American Association for the Advancement of Science
1776 Massachusetts Avenue, N.W.
Washington, DC 20036

Founded in 1848, the American Association for the Advancement of Science (AAAS) has more than 127,000 members, not all scientists. In 1969, the Board of Directors stated that "for the coming decade the main thrust of AAAS attention and resources shall be dedicated to a major increase in the scale and effectiveness of its work on the chief contemporary problems concerning the mutual relations of science,

technology, and social change, including the uses of science and technology in the promotion of human welfare." The Association publishes *Science* magazine (founded by Thomas A. Edison), played a pivotal role in starting NOVA (a weekly television series produced by WGBH/Boston for PBS), and provides other programs in science education. In addition, it supports special programs in international cooperation, science and public policy, and opportunities in science.

The AAAS offers books, compendia, tapes, and films, all listed in its free *Catalog*. The catalog is available from The American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington, DC 20005, as are all materials offered for sale:

Electronics: The Continuing Revolution, 1977; casebound, $12.95; paper, $4.95.

Population: Dynamics, Ethics, and Policy, 1975; casebound, $12.00; paper, $4.50.

Science for Society: A Bibliography, more than 2500 references dealing with areas in which science and technology impact on society. 1976; paper, $3.00.

Scientific Freedom and Responsibility, report of an ad hoc AAAS Committee on Scientific Freedom and Responsibility, prepared by John T. Edsall; 1975; paper, $3.00.

Tape recordings of the Annual Meetings of the AAAS include:

356-77T—*Humanity in Science: A Perspective and a Plea*, $9.00.

223-76T—*Energy and Food Production: Contemporary Technology and Alternatives*, $36.00.

243-76T—*Man-Computer Relations: What Will They Be?*, $18.00.

268-76T—*Science and Social Risk*, $18.00.

277-76T—*Technology and Values*, $18.00.

According to Arthur H. Livermore, Head of the Office of Science Education of the AAAS, the organization does not have a speakers' bureau. However, he can, on short notice, provide names of AAAS members who would be willing to speak on a wide variety of topics. Contact Mr. Livermore directly to obtain this information.

American Astronautical Society
6060 Duke Street
Alexandria, VA 22304

Basically an information exchange organization for scientists, the American Astronautical Society seeks to advance the astronautical sciences and further the progress of space exploration.

Though most of its publications are technical, some offer insight into the interface of technology and government or give information about the practical on-Earth benefits of space science. Write to the above address for a listing of pre-prints.

For speakers, write to Peter M. Bainum (above address), who may be able to arrange for someone from the Society to appear at one of your meetings.

American Institute of Aeronautics and Astronautics
1290 Avenue of the Americas
New York, NY 10019

The membership of the American Institute of Aeronautics and Astronautics is limited to professionals in those fields. Though many of the publications of the Institute are too technical for the lay reader, several written at the nonprofessional level might be helpful to those participating in this program. The AIAA Publications Catalog, which provides a full listing and order forms, is free upon request.

77-215 *Overview—A Look into the Future of Air Transportation*, John J. Casey, $2.50.

77-311 *Historical Overview* (of air transportation), Ronald D. Neal, $2.50.

77-271 *Historical Perspective of Computation in Aviation and Aerospace*, Courtland Perkins, $2.50.

77-272 *A Forecast of the Future of Computation*, Carl Hammer, $2.50.

77-323 *Communications Satellites*, Joseph V. Charyk, $2.50.

77-337 *History of Manned Space Flight*, Robert R. Gilruth, $2.50.

3rd Urban Technology Conference and Technical Display—papers presented to a conference whose objective was to improve communication between those who generate technology and those in urban situations who use it. $20.00.

Space—A Resource for Earth. An *AIAA Review Series* publication—a nontechnical book on applications of space systems to improving the quality of human life on earth. $8.50.

The Impact of Competitive Technology on Engineering Management—papers from a conference on the world-wide distribution of technological power, technology transfer, technology assessment. $5.00.

Two motion pictures are available for sale:

America's Wings, 28½ minutes, a history of the technological evolution of the airplane. $180.00.

The Age of Space Transportation, 20 minutes, the effects of the Space Age on medicine, geophysics, astronomy, and other fields. $150.00.

Audio-visual presentations (slides, audio cassettes, and printed scripts) can be purchased for $69.50 each, including shipping charges:

Earth Resources, a View from Space, 60 slides, 28 minutes, the story of the satellite Landsat, which has been beaming down information about the Earth since 1972.

Perspectives on Space, 79 slides, 29 minutes, an overview of the space program, with emphasis on the impact of space technology on everyday life.

Aircraft Noise: Taming the Tiger, 64 slides, 30 minutes, a discussion of the problem of noise in general, aircraft noise in particular.

Via Satellite, 78 slides, 30 minutes, a history of communications technology since Samuel Morse.

Space for Earth: 1980–2000, 80 slides, 28½ minutes, a discussion of possible future technological advances like wrist-radiophones, teleholography, solar power satellites.

To arrange for a speaker, contact the section of the AIAA in your area. A list of the sections is available from AIAA headquarters at the above address.

American Public Works Association
1313 East 60th Street
Chicago, IL 60637

A nonprofit organization of public works officials, American Public Works Association acts as an information clearinghouse and meeting ground for its members.

Its list *Publications for Professionals* describes the group's free publications. Though most are highly technical, *Dynamic Technology Transfer and Utilization*, a 77-page book produced in association with Indiana University, contains some pertinent information about why it is difficult to transfer technology from one culture or locality to another, how local technologies are created, and why some local technologies remain local and are not adopted elsewhere. In addition, the book gives ten case histories of technology in action (for example, mechanized refuse collection in Scottsdale, Arizona) and discusses the use of electronic data processing applications. A single copy is free from the above address. For information about speakers, contact Robert Samborski, Director of Institute Affairs.

Association of Science-Technology Centers
1016 Sixteenth Street, N.W.
Washington, DC 20036

An association involved in developing science-technology centers and traveling exhibits, this group is a source of information about what museums in your area are planning. The publications catalog lists:

Directory of Exhibits at Science and Technology Centers, a listing of over 300 permanent exhibits in 40 institutions around the world, $8 to nonmembers.

Discover and Learn at Science and Technology Centers, an illustrated booklet of member institutions, $2 to nonmembers.

Traveling Exhibitions: An Overview of Not-for-Profit Traveling Exhibitions Services, $3.50 to nonmembers.

Traveling Exhibits Service Catalog, illustrated booklet of exhibits and films circulated by the Association, free.

Bureau of Mines
United States Department of the Interior
2401 E Street, N.W.
Washington, DC 20241

The Bureau of Mines was created by Congress in 1910. Since 1973, several reorganizations have narrowed its responsibilities so that it has become primarily a research and statistics agency. The Bureau "conducts scientific and engineering research in metallurgy and mining, compiles and analyzes statistical information on nonfuel mineral supply and demand, and investigates mineral potential of Federal lands proposed for preservation as parks, refuges, and other special purposes."

The Bureau offers many free publications, which may be requested from the Branch of Publications Distribution, 4800 Forbes Avenue, Pittsburgh, PA 15213. Examples:

Mining Research, a 38-page document, covers research done by the Bureau in non-coal mine technology, environmental effects of mining and reclamation technology, future directions.

The Miniplant Concept: Aluminum for America's Future is a booklet describing new technology for extracting aluminum.

Clean Power from Coal: The Bureau of Mines Citrate Process provides a layman's explanation of new technology for processing coal with minimum air pollution.

To Save the Land shows how problems created by strip mining can be solved.

A number of films are available on loan from Motion Pictures, Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, PA 15213. Borrower pays only return postage. A film catalog is free. Among the films is a series about the natural resources of several states, historical background on the development of those resources, and the use of modern technology for conservation and industrial exploitation:

Arizona and Its Natural Resources, color, 28 minutes. (178)

Nevada and Its Natural Resources, color, 27 minutes. (233)

Oregon and Its Natural Resources, color, 27 minutes. (242)

Washington and Its Natural Resources, color, 27 minutes. (246)

Tennessee and Its Natural Resources, color, 28 minutes. (268)

Pennsylvania and Its Natural Resources, color, 28 minutes. (272)

Another series gives the history of the use of various minerals, shows how they are used in industry, provides information on the latest technology used in mining, processing, and fabricating. Examples:

The Magic of Sulphur, color, 26 minutes. (255)

Copper, the Oldest Modern Metal, color, 27 minutes. (256)

Cast Iron—the Biography of a Metal, color, 25 minutes. (259)

The Extraordinary World of Zinc, color, 28 minutes. (262)

Silver, color, 28 minutes. (265)

Tungsten, color, 18½ minutes. (275)

Symbol B Number 5 . . . Boron and the Borates, color, 28 minutes. (278)

Individual films include:

The Minerals Challenge, color, 27 minutes. This film shows how ever-increasing needs for fuels, metals, and other mineral materials are being met by technological advances. (271)

The Moving Earth—The Story of Mined Land Subsidence Control, color, 27 minutes. Sometimes technology solves problems it has created—in this case ground subsidence, a serious environmental side-effect of strip mining. (273)

Speakers are available through State Liaison Officers, listed in the booklet *The State Liaison Program of the Bureau of Mines*.

Council for Agricultural Science and Technology
Cast Memorial Union
Iowa State University
Ames, IA 50011

This association of companies, societies, and individuals is devoted to the investigation of current national issues in agriculture. Single copies of the Council's publications are free on request from the above address. Examples:

Ruminants as Food Producers—Now and for the Future, Special Publication #4 (1975)

Pesticide Report to the Nation, Special Publication #3, (1974)

Energy Use in Agriculture—Now and for the Future, Report #68 (1977)

Nitrite in Meat-Curing: Risks and Benefits, Report #74 (1978).

The Phenoxy Herbicides: Second Edition, Report #77 (1978).

Dietary Goals for the United States: A Commentary, Report #71 (1977).

Earthrise
Box 120 Annex Station
Providence, RI 02901

Earthrise is a small, nonprofit organization that maintains that "we can have both a sound economy and an ecologically balanced environment, and . . . we can achieve social justice and an efficient political structure."

Publications, all costing $1.25 and available from the above address, include:

#14 *Earthrise Update:* description of the organization's activities and goals; "Futures Paradigm"; "Apocalypse Syndrome."

#15 *Urban Futures:* bibliography; description of Futures Lab student work; review of two energy documents; clearinghouse.

#23 *Third World:* "The Rise of the Third World"; a Latin American world model; "India Tomorrow"; UN Conference on "Self Reliance and Global Partnership"; letters; reports on a Futures Information Network and an Institute for Anticipatory Democracy; clearinghouse.

The *Global Futures Game*, at $17.75, is a participatory exercise allowing players to "simulate political, environmental, and social development on a global scale" to the year 2020. The game sets up simulation of conditions in terms of population, food, technology, education, and relative growth rates. From 8 to 48 people can play, and the game requires two to three hours to complete.

Information about slide lectures and speakers is available on request.

Federal Communications Commission
1919 M Street, N.W.
Washington, DC 20554

An independent Federal agency created by Congress, the FCC is charged with regulating interstate and foreign communication by means of radio, television, wire, cable, and satellite. Since its creation in 1934, it has, of necessity, expanded its operations as a result of technological innovations in communications. In

connection with its research activities, the FCC has a laboratory at Laurel, Maryland.

Single copies of Information Bulletins issued by the FCC may be obtained by writing to the FCC Public Information office at the above address. Of interest are:

Information Services and Publications (1)

The FCC in Brief (4)

A Short History of Electrical Communication (6)

Regulation of Wire and Radio Communication (10)

Educational Television (12)

Subscription TV (16)

Educational Radio (17)

Cable Television (18)

For speakers, write to Consumer Assistance Office, Federal Communications Commission, at the above address.

The Ford Foundation
320 East 43rd Street
New York, NY 10017

The Ford Foundation grants funds to individuals and organizations, both in the United States and abroad, for research, experiments, development, and education that could contribute to the solution of problems of national or international importance. Projects funded by the Foundation include a study of the effects of the Aswan Dam in Egypt; development of a computer model of plant and animal life in an Egyptian desert; a consideration of electronic mail service; a study of the effects on communication of new electronic devices.

A free copy of *Ford Publications and Films* and other free items may be obtained by writing to the above address. Order books and other publications, prepaid, from Ford Foundation, P.O. Box 1919, New York, NY 10001. Of interest are several publications dealing with various aspects of technology:

Technology and Cities—A Foundation Viewpoint, William C. Pendleton, from an address delivered at the Conference on Impending Technology—Its Challenge to Livable Cities, at the Georgia Institute of Technology in 1968 (free). (134)

The Human Side of Productivity, Basil J. Whiting, from remarks before the Senate Committee on Government Operations, 1974 (free). (336)

The Art of Managing the Environment, a report on six experiments in regional environmental management designed to provide a setting in which staff from various disciplines and agencies can work together to solve common problems (free). (318)

Understanding Population, a report on Foundation-supported research and training centers studying world population problems. (351)

Reproduction and Human Welfare: A Challenge to Research—Summary Chapter, Roy O. Greep, Marjorie A. Koblinsky, and Frederick S. Jaffe, reprinted from *BioScience*, November, 1976 (free). (357)

A Work Experiment: Six Americans in a Swedish Plant, a report on the reactions of six Detroit auto workers to new methods of engine assembly in Sweden. Single copy, $3.00; 10 or more copies, $2.50 each. (X13)

Exploring Energy Sources: A Preliminary Report, an exploration of the crisis in energy, alternative solutions, environmental impact of those solutions. Single copy, $.75; 50 or more copies, $.60 each. (X04)

The Ford Foundation also offers films, available through: Films Incorporated, 1144 Wilmette Avenue, Wilmette, IL 60091. Among them:

Technology in Public Service, color, 20 minutes, an introduction to how Public Technology, Inc. works with governments to improve services through the innovative application of technology. Purchase, $275.00; rental, $25.00.

Changing Work: American Workers in Sweden, color, 40 minutes, a documentary showing how six American auto workers reacted to Sweden's answer to assembly-line monotony—small, autonomous work groups. Purchase, $400.00; rental, $35.00.

Ford Motor Company
The American Road
Dearborn, MI 48121

The second-largest automobile company in the world, Ford was started in 1903 by Henry Ford, pioneer of the industry. Since then, it has produced nearly 150 million vehicles and is now a huge, multinational corporation. Ford offers the following free publications:

Ford, A Global Corporation, by business historian David L. Lewis, traces the development of multinationals from 2500 B.C., when Sumerian traders established branch offices in foreign countries.

Ford and Public Concerns describes the company's involvement in South Africa and Egypt, environmental concerns, and research programs in automobile technology.

An American Legend is a short biography of Henry Ford.

A Car Is Born covers the production of an automobile from idea to completion.

Available from the Educational Affairs Department

are cards offering capsule coverage of a number of topics. Of special interest is "The Evolution of Mass Production," which traces the development of mass production techniques from Eli Whitney's interchangeable parts to modern-day automated, computer-controlled techniques.

The Hastings Center
Institute of Society, Ethics and the Life Sciences
360 Broadway
Hastings-on-Hudson, NY 10706

A research and educational organization, the Institute of Society, Ethics and the Life Sciences concentrates on issues in medicine and biology, many of which involve technology—e.g., government support of life-extending technologies, genetics research, questions of the regulation of population size. The Institute, founded in 1969, has been involved in testifying before Congress, advising in court cases, and disseminating information.

The Hastings Center Report, published six times a year, is available to members of the group. (An individual membership costs $19.00.)

In a recent Publications List were the following items of interest to those involved in the *Connections* program:

The Hastings Center Report, October, 1977, which contains "Politics and Genetics: The Link Between Science and Values," $3.50.

"Health and Society: Some Ethical Imperatives," 3402, $.30.

"Who Shall Live When Not All Can Live?" and "Reply," 125, $.45.

"Legal and Ethical Implications of Reducing Immigration as Part of a Comprehensive Population Policy," 3, $.85.

"Procreative Rights and Population Policy," 12, $.30.

"The Business Community and Population Policy," 4, $.95.

"Social Justice and Equal Access to Health Care," 124, $.45.

"Industry, Society, and Genetic Engineering," 4005, $.15.

All can be ordered from the above address.

IEEE Computer Society
Institute of Electrical and Electronics Engineers
Post Office Box 639
Silver Spring, MD 20901

The membership of the IEEE Computer Society is restricted to professionals in the field, and their publications, listed in their Publications Catalog, reflect this. However, a few of the Society's books are at a non-technical level:

International Conference on Computer Communications. An international interdisciplinary forum for non-technical as well as technical people, the conference covered activities in computer communications and applications possible through data transmission, as well as social and economic implications. 1976, 655 pages; $35.00 to nonmembers (050); microfiche, $17.00 (M03).

Computer Security. This set of readings and associated tutorial is intended as an overview of the interrelationships of concerns and technologies in the field of computer security. 1977, 448 pages; $12.95 to nonmembers. (139 [77 EH-1124-8])

Speakers on subjects such as security and privacy, the impact of computers on society, and projections into the 1980s are often available through local chapters of the Institute of Electrical and Electronics Engineers. A list of chapters is available from the IEEE at the address above.

Institute for the Future
2740 Sand Hill Road
Menlo Park, CA 94025

An independent research organization which has been in existence since 1973, the Institute for the Future studies ways in which computers can be used to aid communication among groups of people widely separated by distance. Supported in part by grants from the Advanced Research Projects Agency and National Science Foundation, the Institute has developed a computer conferencing system, PLANET, already field-tested by a number of groups. Its primary aims are studies of the long-range future, including effects of technology; development of methodology to make such studies; the dissemination of information about the results of their research; and training of selected people with respect to such research activities.

The free *Publications List* describes reports, papers, working papers, and other materials available from the Institute.

Communicating the Future, Andrew J. Lipinsky, reprint of an article originally published in *Futures*, April 1978, $1.50.

Social Evaluations of Teleconferencing, Robert Johansen, reprint of an article from *Telecommunications Policy*, December 1977, $2.00.

America's Continuing Revolution—the Dispersion of Power, Gregory Schmid, reprint of an article from *Executive*, Spring 1978, $1.50.

Some Observations on the Interaction of Technology

and Society, Roy Amara, reprint of an article from *Futures*, December 1975, $1.50.

Mapping Views of the Future in a Small Group, Robert Johansen and John A. Ferguson, reprint from *Futures*, April 1976, $1.50.

Climate Change to the Year 2000: A Survey of Expert Opinion, conducted by the Research Directorate of the National Defense University with the U.S. Department of Agriculture, Defense Advanced Research Projects Agency, National Oceanic and Atmospheric Administration, and Institute for the Future (Roy Amara and Hubert Lipinski), 1978, $1.00 handling charge.

Available free are a research services brochure and a newsletter, published four times a year, which discusses subjects like electronic meetings and other projects of the Institute.

National Bureau of Standards
United States Department of Commerce
Washington, DC 20234

Since 1901, the National Bureau of Standards, the nation's physical science and measurement laboratory, has provided the basis for our measurement standards. Through close collaboration with governments, universities, and other institutions, the Bureau is presently involved in projects ranging from studies of the safety of children's toys to computer utilization to investigations of outer space.

For sale through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, are several National Bureau of Standards publications. Among them:

Science on Its Way to Work—describes the work of the Bureau and influences of technological change on standards. $1.60. (GPO #003-003-01943-7)

Automation in the Marketplace—explains automated cash registers, bank teller machines, and grocery store check-out systems. $.90. (GPO #003-003-01969-1)

A film catalog (LC 1095, 1978) describes films available on free loan to various organizations (including educational ones) and gives ordering instructions. Examples of pertinent films are:

Demonstration in Urban Noise Control, color, 3 minutes—shows technological solutions to a technological problem.

NBS Noise Presentation, color, 10 minutes—presents and measures various sources of noise pollution: industry, construction tools, rock bands.

Standards for Excellence, color, 28½ minutes—starts at Monticello with a presentation of Thomas Jefferson's standards for time, weights, and measures; traces the growing need for standards in a world of increasing technological complexity.

Speakers are available by contacting Madeleine Jacobs, Public Information Division, National Bureau of Standards.

National Science Foundation
1800 G Street, N.W.
Washington, DC 20550

An agency of the United States government, the National Science Foundation is dedicated to the support of scientific research. It is interdisciplinary.

Mosaic, the Foundation's six-times-a-year magazine, is edited for nonspecialists and reports on the scientific research supported by the Foundation. Though not all the articles in the magazine are pertinent to the CbN topics, many are of great interest. Examples: "Automating the Assembly Line" (1976); "A Science Base for Manufacturing" (1976), "Do Cities Change the Weather?" (1974). (Note: These articles have been reprinted in *Frontiers of Science*, 1977, an anthology of past reports; a new edition of this book can be obtained from the Foundation.) Subscriptions to *Mosaic* are available through the Superintendent of Documents, Government Printing Office, Washington, DC 20402 at a cost of $8.55 a year.

The Foundation offers films on free loan. These are listed in their film catalog (#78-59), obtainable from Forms and Publications, at the above address. Films that run about 5 or 6 minutes are available from Association Films, 1111 North 19th Street, Suite 404, Arlington, VA 22209, Attn. Steve Mahan. They include:

Promise of Plato, about an experiment using Computer-Assisted Instruction in the classroom.

Earth Resources Technology Satellite, illustrating how space technology enables scientists to look at the globe in order to benefit people through increasing food supplies, discovering mineral resources, and so on.

Experimental Forest, about alternatives to clear-cutting forests for timber.

City with a Better Idea, a look at Tacoma, Washington, which is using aerospace technology in public services.

The Future Environment: Your Choice, showing how goals of clean air and water and abundant energy can be met with the assistance of economic models.

Feature films may be obtained from several sources, all listed in the catalog. Among these films are:

RANN—a Progress Report, 14 minutes, showing how researchers are using science and technology to find solutions to environmental and energy problems,

to increase food production, to provide better health care, and to improve the quality of life. (Modern Talking Picture Service, 2323 Hyde Park Road, New Hyde Park, NY 11040)

What about Tomorrow?, 18½ minutes, an exploration of basic research into depletion of the ozone layer, laser chemistry, earthquake prediction, and other technological concerns. (Modern Talking Picture Service)

Oak Ridge Associated Universities
Post Office Box 117
Oak Ridge, TN 37830

The name Oak Ridge Associated Universities is a misnomer—this organization is not a university, has no student body, grants no degrees. It is a not-for-profit corporation of 45 institutions of higher education that conducts educational programs, research, and training, primarily for the Department of Energy, but also for other agencies, both public and private. Oak Ridge, a secret city during World War II, is now an internationally known center for scientific research and development.

The American Museum of Science and Energy, based in Oak Ridge, offers demonstrations, hands-on exhibits, and displays of gadgets and machines, all designed to tell the story of energy. The Museum Division also provides exhibits, with teacher-demonstrators and accompanying curriculum materials, which travel from place to place in 27 states. In addition, modular exhibits, which are designed for easy handling by local sponsors, are available. Write to the Science Educational Resources Center at the above address for more information.

The Energy Education Division operates high school demonstration programs (*This Atomic World*) and a series of seminars on energy (*Energy Today and Tomorrow*) planned for adults at civic and community meetings. *Albert Einstein: A Moiet*, a character study of Einstein presented as a play, tours the country. For further information about scheduling, sponsorship, and performance schedules, write the Energy Education Division.

Publications include a Newsletter (free on request), which contains articles on new energy technologies.

A Traveling Lecture Program welcomes requests for speakers from organizations affiliated with colleges and universities. Sponsoring organizations are responsible for providing local transportation, lodging and food. Many lectures, given by scientists, are planned for laymen and deal with subjects of interest to those participating in *Connections: Technology and Change*—for example, "Communication to the Public on Technical Topics by Government Agencies—A Matter of Limits," "An Assessment of Mechanisms that Aid Worker Adjustment to Technological Change," "The Personal Computer Revolution," "Carbon Dioxide and Climate: The Role of the Terrestrial Biosphere." Write Traveling Lecture Program, University Programs, at the above address.

Office of Technology Assessment (OTA)
Washington, DC 20510

Created in 1972, the Office of Technology Assessment's purpose is to provide Congress with "early indications of the broad range of impacts of technological applications on our society." With this information, members of Congress can examine long-range issues and come to well-considered conclusions. Priorities of the OTA for 1979 include Alternative Global Food Futures; Technology and World Population; Impacts of Technology on Productivity, Inflation, and Employment; Peace Technology; Impact of Microprocessing on Society; Future of Military Equipment; Weather and Climate Technology; Electrical Vehicles. A book explaining these priorities is available from OTA, as is a list of publications (OTA-P-58). Publications, some of which are listed here, can be ordered from the Superintendent of Documents, United States Government Printing Office, Washington, DC 20402.

Development of Medical Technology: Opportunity for Assessment (GPO #052-003-00217-5), effects of new technology; nine case histories. $1.80.

Government Involvement in the Innovation Process—A Contractor's Report (GPO #052-003-00576-0), the role of the Federal government in influencing the introduction of new technologies, goods, and services into the marketplace. $2.50.

Impact of a Department of Education on Federal Science and Technology Activities (GPO #052-003-00573-5), suggested criteria for evaluating the impacts of a new Department of Education on education programs in science and technology.

Public Interest Research Group
1346 Connecticut Avenue, N.W., Suite 419a
Washington, DC 20036

A Ralph Nader organization, the Public Interest Research Group (PIRG) does research, testifies before Congressional committees, and lobbies in Congress for issues of public concern.

Order publications from PIRG by writing to Public Interest Research Group, P.O. Box 19312, Washington, DC 20036. All orders should be prepaid. A publications list is available upon request. Of interest are:

Letter to Energy Research and Development Administration (ERDA) from Center for Science in the Public

Interest, Consumer Action Now, and PIRG, July, 1977. The letter points out weaknesses in a public education project on solar energy, operated by Honeywell, Inc., under contract to ERDA. 10 pages, $.70.

Consumer Participation in the Regulation of Public Utilities, Robert Leflar and Martin Rogol. This reprint (1976) provides a model statute for establishing a consumer group to participate in public utility regulation. 32 pages, $.50 for postage.

Energy Efficiency, the Economy, and Jobs, a 1978 address by Ralph Nader. This pamphlet discusses the intricate relationship of energy decisions on the poor, energy efficiency, and the economy. 13 pages, $1.10.

Asbestos Contamination in School Buildings, Gaylord Bourne. A discussion of the dangers of asbestos to health emphasizes how technology has caused hazard in commercial buildings and what can be done about it. $7.00 to institutions, $3.50 to individuals; make checks payable to Disability Rights Center.

Multinational Monitor, Vol. 1, No. 1: Winter 1978-1979. Much of the information in this bulletin in newspaper format has to do with technological contamination of other countries through export of hazardous jobs, disease, and pollution. $1.00.

Public Technology, Inc.
1140 Connecticut Avenue, N.W.
Washington, DC 20036

This is a non-profit organization designed to serve "the governmental needs of cities, counties, and states." It utilizes new technology to improve delivery of public services and reduce their costs.

Publications, available free from the above address, include:

77/055—*Public Technology, Inc.: A New Institution for Local and State Governments.*

77/056—*Technology Transfer for Local Government: A Five-Year Progress Report.*

78/001—*Public Technology Newsletter,* sample issue.

78/002—*PTI Publications List,* current update.

78/075—*Urban Technology System Technical Briefs*—concise summaries of over 130 methods for solving government problems.

76/015—*Transportation Planning and Impact Forecasting Tools,* emphasis on Urban Transportation Planning System (UTPS) planning package.

78/014—*Alternative Work Schedules,* ways of relieving traffic congestion that complicates planning and operation of transportation systems.

Robot Institute of America
20501 Ford Road
Dearborn, MI 48128

The Robot Institute of America, a professional organization dedicated to the development and advancement of robotics, produces information, most of it technical, in the form of newsletters, seminars, conferences, research reports, market studies, case histories. Videotape/films, showing robots in action, are available from George W. Kipper, Technical Divisions, Society of Manufacturing Engineers (at the address above). An example is:

The Industrial Robot—An Introduction, 20 minutes. The film begins with an explanation of how the robot developed and why it has become a part of modern industry, then goes on to show robots at work. Price to nonmembers: rental, $40; sale, $200.

The Rockefeller Foundation
1133 Avenue of the Americas
New York, NY 10036

Endowed by John D. Rockefeller in 1912, The Rockefeller Foundation is chartered to "promote the well-being of mankind throughout the world." At present, it has five programs: Arts, Humanities, and Contemporary Values; The Conquest of Hunger; Equal Opportunity; International Relations; Population and Health.

RF Illustrated, a newspaper-format magazine/newsletter issued about twice a year, contains articles of interest on topics such as agricultural research, contraceptive technology, environment; new publications of the Foundation are listed in its pages. Examples of past publications: *The Education of Women for Technological Societies; International Problems in Environmental Monitoring; Bellagio IV Population Conference* (position papers); *Society, Culture, and Agriculture.* Most of the publications, all of which are free, go out of print rapidly, so it is best to request inclusion on the mailing list for *RF Illustrated,* then order current publications listed there.

Scientists' Institute for Public Information
355 Lexington Avenue
New York, NY 10017

Plans of the Scientists' Institute for Public Information for 1979 include broadening the science information program and audience. It's goal: "to ensure public access to full information on vital science policy issues." Current programs (among others): presenting information on energy alternatives and their employment impact to labor; working to meet information needs of inner-city community organizations; analyzing the social implications of law enforcement's use of technology, particularly computer

technology; bringing together viewpoints and data on nuclear waste management so that all involved can agree on a data base.

Membership in the Institute, which is open to non-scientists, costs $25 annually and includes subscriptions to *Sipi Scope* (a bimonthly newsletter) and *Environment Magazine*.

Publications, available from the above address, include:

Synthetic Fuels and Cancer, $1.50 plus $.28 first class.

Energy Conservation, Employment, and the Economy, $2.50 plus $.93 first class.

Nuclear Power, Economics, and the Environment, $2.50 plus $1.06 first class.

Economic Implications of Energy Conservation, $5.00 plus $1.80 priority rate.

Air Pollution, $6.00 plus $1.80 priority rate.

Water Pollution, $6.00 plus $1.80 priority rate.

Radioactive Contamination, $6.00 plus $1.80 priority rate.

NOTE: The last three books are part of a Harcourt Brace Jovanovich series produced by Scientists' Institute for Public Information.

Smithsonian Institution
Washington, DC 20560

Englishman James Smithson left his property to "the United States of America, to found at Washington, under the name of the Smithsonian Institution, an Establishment for the increase and diffusion of knowledge among men." Smithson died in 1829, and the Institution was founded in 1846. Its Establishment consists of the President of the United States and other high government officials. A Board of Regents, drawn from the private as well as the public sector, administers the Institution's affairs. The Smithsonian Institution is involved in research, maintains a library, and publishes books and other materials. Under its aegis fall many museums, including the National Museum of History and Technology and the National Air and Space Museum; the Smithsonian Astrophysical Observatory; the National Zoological Park; and several international programs.

Smithsonian Institution Press
Washington, DC 20560

A service publisher for the Smithsonian Institution (research, collections, exhibits) and also a publishing house similar to a university press, the Smithsonian Institution Press produces from 150 to 200 publications each year—pamphlets, brochures, flyers, monographs, and books. All Smithsonian Institution Press publications produced with federal funds (the majority) must be purchased through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Trade books may be purchased directly from the Press. A catalog may be obtained from the Press. Typical publications of interest are:

How Presses Print, Claudia Okaes. 16 pages, 1977, $.85.

Steam Locomotives, John White. 16 pages, 1977, $.85.

"Langley's Aerodrome," 1978 (folder, free).

Georg Scheutz and the First Printing Calculator, Uta Merzbach. 74 pages, 1977, no price listed.

United States Standards of Weights and Measures: Their Creation and Creators, Arthur H. Frazier. 21 pages, 1978, no price listed.

Galileo Galilei: Operations of the Geometric and Military Compass, translated by Stillman Drake. 100 pages, 1978, prob. $5.95. Drake, in introducing Galileo's own treatise on his compass, likens its social impact to that of the pocket calculator today.

MANtransFORMS, Hans Hollein. 172 pages, 1978, $5.95. The author offers insights into the hidden human factors that influence design—our effect on technology.

The Men and Machines of American Journalism: A Pictorial Essay, Peter C. Marzio. 144 pages, 629-9, $3.95. A history of news in America from the standpoint of the interplay between men and machines, the book aims to show that revolutionary periods in journalism have occurred when imaginative journalists have made the most of the technology at their disposal.

Individual members of the Press staff are sometimes available for speaking engagements. Address inquiries to E. F. Rivinus, Director, at the above address.

Smithsonian Traveling Exhibition Service (SITES)
Washington, DC 20560

This service of the Smithsonian Institution takes the exhibitions it offers beyond the nation's capital to communities everywhere in the United States. The exhibitions, designed for easy handling and set-up, are described in *Update*, a catalog available from the Smithsonian. Because the displays are rented for a month, it would probably be best for you to encourage your college, local library, museum, or various community groups (perhaps a consortium formed for this purpose) to rent the exhibitions, which come with background material, catalogs, bibliographies, educational materials, and promotional kits—even tips on how to get public funding for the exhibits.

Examples:

Images of Earth from Space, 50 photographs. Full-color photographs of Earth taken by Landsat satellites combine technology with aesthetics and inform the viewer (in labels and text panels) of practical uses of such photography in surveying environment and resources. $500.

Man in His Environment, 30-minute, color film; free-standing panels; six exhibit areas—energy, waste, food, population, lifestyle, limited resources; six mini-dioramas. Modular. Designed and produced by the Field Museum, Chicago, this exhibition presents the planet in terms of its ecological systems and the ways in which people are imposing themselves on those systems. Questions: How many people can the world feed? How much will it cost? What kinds of technology can be imposed on natural systems without destroying them? $560.

Visionary Architecture, 70 drawings by architects, planners, engineers. This exhibit presents aspirations—technological and utopian—for improvement of the environment. $2000.

American Agriculture: A Continuing Revolution, 44 photopanels. The three revolutions of American agriculture ("horsepower revolution," "mechanized revolution," "green revolution") are the subject of this SITES exhibit. $200.

Extra! Extra! The Men and Machines of American Journalism, 44 photopanels. From hand presses to television, technological change has had a strong influence on the ways in which news has been gathered and reported. This exhibition, adapted from the Henry Luce Hall of News Reporting in the National Museum of History and Technology, tells the story. $100.

Technology Transfer Society
11720 West Pico Boulevard
Los Angeles, CA 90064

Organized in 1975, the Technology Transfer Society is open to technologists, scientists, economists, people in business, and other professionals or students interested in promoting its goal—to accelerate the communication of technological advances from the laboratory to the commercial sector. Nonprofit and international, it is a corporate member of TECHNOTEC, the technology exchange service of Control Data Corporation. The Society produces the *Bibliotech Library*. Volume 1, *Technology Transfer: A Bibliography*, outlines in bibliographic form the evolution of technology transfer throughout the last decade. Edited by J. R. Perrin and Susan Underwood, with an introduction by Herb Rosen, it was produced in association with Documentation Associates, contains 20 pages, and is available for $5.00, prepaid. Interested people can be included on the Society's mailing list. To obtain speakers, write to the Society, who will assign people as membership permits.

United States Consumer Product Safety Commission
Washington, DC 20207

The work of the U.S. Consumer Product Safety Commission, established in 1973, affects the design, construction, contents, packaging, and labeling of more than 10,000 consumer products. It is a watchdog agency, whose primary goal is to reduce injuries associated with consumer products. Priorities for action in 1978-1979 include litigation on aluminum wiring (cause of fires) and consideration of mandatory regulation of power mowers, benzene, space heaters, miniature Christmas tree lights, and other products of modern technology. It is also involved in investigation and control of potentially cancer-causing substances, such as those in children's sleepwear, and it will possibly do research on asbestos, CB and television antennas, energy conservation, projectile toys, and smoke detectors.

In general, 10 copies or less of fact sheets and some other publications can be obtained free by writing to the above address. Quantities of more than 10 can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. For further information, write the Commission for *A Catalogue of Publications, Radio, Films, Slides, Fact Sheets, T.V.*

Some Fact Sheets of interest are:

"Why Doesn't Somebody Do Something?"—a flyer describing the responsibilities of the Commission (GPO #052-003-00034-2; $.35 per copy).

"Public Participation in Standards Development," Fact Sheet #30 (GPO #052-011-00031-1, $2.65 for 50 copies).

"Aerosols," Fact Sheet #33 (GPO #052-011-00034-5, $2.65 for 50 copies).

"Vinyl Chloride," Fact Sheet #58 (GPO #052-011-00056-6, $1.75 for 50 copies).

How-to Manual for Product Safety—People Make It Happen—a guidebook for organizing community programs on product safety (GPO #052-011-00152-0, $3.25 per copy).

"Asbestos," Consumer Alert Sheet.

Consumer Information Catalog—lists more than 200 free or low-cost publications developed by more than 24 federal agencies. (Write Consumer Catalog, Pueblo, CO 81009.)

Films are available on free loan from 26 regional offices of Modern Talking Pictures, Inc. (listed in the

agency's catalogue of publications) or may be purchased from National Audiovisual Center, Order Department, Washington, DC 20409.

Play It Safe, color, 11 minutes—safety tips for using power lawn mowers and hedge trimmers. Price: $56.75.

People Make It Happen, color filmograph, 23 minutes—describes the safest selection, use, maintenance, storage, and disposal of consumer products. Price: $113.50.

United States Department of Energy
Washington, DC 20585

In 1977, the Department of Energy, the twelfth agency in the Cabinet, was created to consolidate programs and offices dedicated to energy and to carry out the Nation's energy policy. The department is responsible for the research, development, and demonstration of energy technology as well as the marketing of Federal power, energy regulation and conservation, and other energy-related activities.

A catalog of publications is available from the above address. To order publications, write to: Technical Information Center, United States Department of Energy, Post Office Box 62, Oak Ridge, TN 37830. Examples (free):

Energy Technology—describes the research needed to deal with energy needs.

Waste Heat Recovery: More Power from Fuels—explains how the "bottoming cycle" can produce more electric power.

Water Power: Use of a Renewable Resource—surveys uses of hydroelectric power.

Agriculture, Energy, and Society—covers the impact of present-day agricultural methods on energy resources (designed for high schools).

Energy in the Global Marketplace—relates global balances of power to energy prices (designed for high schools).

Films can be obtained on free loan. See the Department of Energy film catalog, available from the above address, for ordering instructions. Examples:

The Atom and Archaeology, 25 minutes, color, #505—shows technology used in interpreting data about ancient civilizations.

The Atom and the Environment, 22 minutes, color, #462—ties atomic energy to environmental concerns.

Conservation—Investing in Tomorrow, 6¼ minutes, color, #517—explores conservation technologies of the present and future.

Energy—A Family Album, 8:33 minutes, color, #518—covers the history of energy use in America and new technologies.

Energy—The American Experience, 28½ minutes, color, #507—follows history (including growth of industry and inventions) with information about new energy technologies.

The Feast, 29 minutes, color, #455—shows a feast between two hostile tribes in the framework of a population genetics study.

Transportation—The Way Ahead, 7:45 minutes, color, #521—covers our dependence on the automobile, alternatives to the internal combustion engine, new energy sources and research.

The Department's Speaker's Bureau is described in their brochure DOE/OPA-0040 (9-78). You can arrange for speakers on a number of technology-related subjects by contacting regional offices, field offices (listed in the brochure), or Washington headquarters.

United States Environmental Protection Agency
Office of Public Affairs
Washington, DC 20460

The U.S. Environmental Protection Agency (EPA) was established in 1970 to deal with problems created by the growth of technology—e.g., noise, garbage, and chemicals in the air and water. An independent agency, it administers laws passed by Congress through its headquarters in Washington and ten regional offices. It uses both incentives to encourage efforts to abate pollution and law enforcement to stop polluters.

Agency publications are listed in a quarterly guide, available free from: U.S. Environmental Protection Agency, Printing Management Office, PM 215, Washington, DC 20460, *or* from one of the agency's regional offices. Non-technical publications are listed in the front section of the guide; those that are free (all those listed below) can be ordered from the same sources. Some examples:

The Challenge of the Environment: A Primer on EPA's Statutory Authority, December 1972.

Earth Trek . . . Explore Your Environment, July 1974.

Atmospheric Lead and Public Health, April 1972.

Trends in the Quality of the Nation's Air, 1977.

Where to Find State Plans to Clean the Air, 1974.

Noise: Unwanted By-Product of Modern Life.

What You Should Know About the Pesticide Law, 1976.

The Automobile Cycle: An Environmental and Resource Reclamation Problem.

Can Engineering Cope with the Debris of Affluence?

DISCUS—A Solid Waste Management Game.

New Technologies in Solid Waste Management.

Use of Solid Waste as a Fuel by Investor-Owned Electric Utility Companies: EPA/Edison Electric Institute Meeting.

Clean Water and Agriculture, 1977.

No Small Task: Establishing National Effluent Limitations Guidelines and Standards, 1976.

The Agency offers films on a free loan basis from two sources:

1) National Audiovisual Center, Film Distribution Branch, Washington, DC 20409.

2) Modern Talking Picture Service, 2323 New Hyde Park Road, New Hyde Park, NY 11040.

Requests should be made at least three months before the date on which you want to show the film. A complete list is included in the brochure *Films from EPA* (free), which can be ordered from the EPA Printing Management Office. Of particular interest for *Connections: Technology and Change:*

The Gifts, revised 1973, 28 minutes. This documentary tells what has happened to the American landscape as a result of resource exploitation and technology. (Modern Talking Picture Service)

Voices, 1974, 28 minutes. Three groups fighting the encroachments of technological advance (roads, airports, dams) are featured. (Modern Talking Picture Service)

A Question of Values, 1972, 28 minutes. People in a Maine town debate the question of whether to allow an oil refinery to be built—jobs vs. oil spills. (National Audiovisual Center)

The First Pollution, 1972, 26 minutes. This film shows technological efforts to stem water pollution. (National Audiovisual Center)

The Second Pollution, 1973, 22 minutes. Air pollution in Los Angeles and Chicago—what's the solution? (National Audiovisual Center)

The Realities of Recycling, 1971, 38 minutes. The film shows new technology being investigated and demonstrated under the provisions of the Solid Waste Disposal Act. (National Audiovisual Center)

Westinghouse Electric Corporation
Westinghouse Building
Gateway Center
Pittsburgh, PA 15222

Westinghouse Electric Corporation manufactures and sells products for the generation, transmission, distribution, and control of electric power. In January, 1979, the company held a Symposium on Technology and Society, a seven-part series examining the impact of technology and industrialization on society. Some of the material from this symposium is available through Paul B. Jones, Manager, Corporate Communications Programs, at the above address.

Technology Talks, a program to communicate with the public on issues involving technology, features speakers from the corporate Research and Development Center. Requests for these speakers should be channeled through Paul B. Jones.

World Future Society
4916 St. Elmo Avenue (Bethesda)
Washington, DC 20014

Founded in 1966 by a group of private citizens, the World Future Society serves as an independent forum and clearinghouse for exploration of the future and seeks, in particular, to "promote the development and improvement of methodologies for the study of the future." Its membership—now over 20,000 people in more than 80 countries—is open to anyone, at costs reflecting the degree of participation ($15.00 to $90.00). All memberships include a subscription to the organization's bimonthly magazine, *The Futurist.*

The World Future Society Catalog, free from the above address, describes memberships, lists publications and other materials, and includes an article, "How Futurists Explore the Future: A Brief Introduction for Newcomers," in addition to a glossary of terms. Of interest:

The Future: A Guide to Information Sources provides a complete listing of educational programs and courses, current research projects, periodicals, books, films, videotapes, games, and other information relating to the future—and its technologies. 1979, $25.00 to nonmembers.

Appropriate Technology, a 24-page reprint, $1.50.

Future of Work and Careers, a 16-page reprint, $1.50.

Tape recordings, listed in the Society catalog, may also be purchased through the Society. Examples:

T-7603 *The Government and Technological Innovation.* Jordan Lewis of the National Science Foundation discusses how the Federal government can affect technology through its purchasing power. (Other side: *Public Policy and Earthquake Protection)* $6.00.

T-7608 *Careful Technology for Our Environment.* Joan Nicholson of the Bolton Institute talks about the need to match man's technology with the ecological system. (Other side: *Growth and the Community Environment*) $6.00.

T-7406 *The Future of the Wired City*. Marvin Cetron, President of Forecasting International, provides a technological assessment of the effects of telecommunications on cities. (Other side: *The Future of Management Communications*) $6.00.

A film, *Toward the Year 2000*, is a television meeting of Herman Kahn, Margaret Mead, and William Irwin Thompson, which centers on agriculture, the atmosphere, energy, the family, famine and flush toilets, genetic engineering, India, industrialization, nationalism, nuclear war, rate-of-change, satellites, and other subjects directly or indirectly related to technology. Video cassette (3/4" or Betamax): purchase, $100; rental, $20. 60-minute audio-cassette, $7.50.

To arrange for a speaker, contact the national headquarters or one of the local chapters of the World Future Society.

Worldwatch Institute
1776 Massachusetts Avenue
Washington, DC 20036

Conceived and designed by William M. Dietel and Lester R. Brown, Worldwatch Institute is an international, interdisciplinary, nonprofit organization primarily funded by the Rockefeller Brothers Fund (though other sources also contribute). Its aim is "to encourage a reflective, deliberate approach to global problem solving."

Worldwatch books, published by W. W. Norton, are available in bookstores and from the publisher, not from Worldwatch.

The Worldwatch Papers, issued six times a year, can be ordered from the above address. A price list is available. Cost: 1 copy—$2.00; 2–10 copies—$1.50 each; 11–15 copies—$1.25 each; 15 or more copies—$1.00 each. A yearly subscription, which costs $25.00, includes all the papers and books originated by Worldwatch.

Some recent papers of interest are:

19. *The Solar Energy Timetable*, Denis Hayes, 1978, 40 pages—concludes that we could get most of our energy from the sun by 2050, with 70 billion square meters of solar collectors and 5 million wind turbines.

21. *Soft Technologies, Hard Choices*, Colin Norman, 1978, 48 pages—discusses criteria for the choice of technologies: energy efficiency, environmental impact, social equity, and best use of resources.

23. *Repairs, Reuse, Recycling—First Steps Toward a Sustainable Society*, Denis Hayes, 1978, 48 pages—talks about ways of reducing waste and recycling materials through local programs as well as centralized facilities.

24. *The Worldwide Loss of Cropland*, Lester Brown, 1978, 48 pages—analyzes loss of cropland through conversion to nonagricultural uses, erosion, desertification, and diversion of irrigation water; presents questions for the future.

25. *Worker Participation—Productivity and the Quality of Work Life*, Bruce Stokes, 1978, 48 pages—discusses labor-management cooperation to improve the quality of work life, raise productivity, cope with economic problems.

25. *Planting for the Future: Forestry for Human Needs*, Erik Eckholm, 1979, 64 pages—presents trends in deforestation and their sources, economic implications, some new approaches to forestry in the Third World.

Part Two: Museums with Exhibits Pertinent to CONNECTIONS

The following list of museums that feature exhibits of interest to participants in *Connections: Technology and Change* was drawn from *The Official Museum Directory 1978/1979*, published by The American Association of Museums in Washington, D.C. The list is by no means exhaustive. Agricultural, medical, and military museums often provide displays of tools and machinery with technological impact on society. Indian and archaeological exhibits show how technology shaped life in simpler times. Historic parks and museum villages show old-fashioned methods of industry in operation. For information about museums in your area, write to Robert Matthai, Cultural Services Group, Box 241, New York, NY 10024.

Alabama

Alabama Space and Rocket Center, Tranquility Base, Huntsville 35807

George Washington Carver Museum, Tuskegee Institute, Tuskegee 36088 (scientific achievements)

Museums of the City of Mobile, 355 Government Street, Mobile 36602 (naval, transportation, fire-fighting equipment)

United States Army Aviation Museum, Building 6007, Fort Rucker 36362 (aircraft)

Wesleyan Archives and Museum, Box 5206, University of North Alabama, Florence 35630 (business machines)

Alaska

Alaska State Museum, Subport, Pouch F.M., Juneau 99811 (early industry)

Arizona

The Arizona Museum, 1002 West Van Buren Street, Phoenix 85007 (transportation)

Bisbee Civic Center and Mining and Historical Museum, P.O. Box 451, Bisbee 85603

Jerome State Historic Park, P.O. Box D, Jerome 86331 (mining)

Arkansas

Museum of Science and History, MacArthur Park, Little Rock 72202

Phillips Company Museum, 623 Pecan Street, Helena 72342 (Edison collection of inventions)

The Plantation Museum, Inc., P.O. Box 38, Scott 72142 (equipment and tools, steam tractors, blacksmith shop)

California

Alexander F. Morrison Planetarium, Golden Gate Park, San Francisco 94118 (space science)

California Division of Mines and Geology, Ferry Building, San Francisco 94111

California Museum of Science and Industry, 700 State Drive, Los Angeles 90037

California Oil Museum, 1003 Main Street, Santa Paula 93060 (oil technology)

Diablo Valley College Museum, Golf Club Road, Pleasant Hill 94523 (scientific instruments)

Eastern California Museum, 155 Grant Street, Independence 93526 (tools and transportation)

The Exploratorium, 3601 Lyon, San Francisco 94123 (art and technology)

Lawrence Hall of Science, University of California, Centennial Drive, Berkeley 94720

Rosicrucian Science Museum and Planetarium, Rosicrucian Park, San Jose 95191 (aeronautics, communications, electricity)

San Diego Aero-Space Museum, Inc., 1649 El Prado, Balboa Park, San Diego 92101

San Diego Hall of Science, d/b/a Reuben H. Fleet Space Theater and Science Center, 1875 El Prado, Balboa Park, San Diego 92101

Space Science Center, 12345 El Monte Road, Los Altos Hills 94022

Colorado

Clear Creek Historic Mining and Milling Museum, 23rd Avenue and Riverside Drive, Idaho Springs 80452

Colorado School of Mines Geology Museum, 16th and Maple, Golden 80401 (mining)

Leadville Assembly, Inc., Box 625, Leadville 80461 (lead mining)

Miners Ridge Museum, P.O. Box 481, Silver Plume 80476

University of Colorado Museum, Broadway between 15th and 16th Streets, Boulder 80309 (tools, musical instruments)

Western Museum of Mining and Industry, 1025 Northgate Road, Colorado Springs 80908

Connecticut

American Radio Relay League—Museum of Amateur Radio, 225 North Main Street, Newington 06111

Bradley Air Museum of The Connecticut Aeronautic Historical Association, Inc., Bradley International Airport, Windsor Locks 06096

Museum of Art, Science, and Industry, 4450 Park Avenue, Bridgeport 06604

Museum of Central Connecticut State College, New Britain 06050 (industry)

Old New-Gate Prison and Copper Mine, Newgate Road, East Granby 06026

Sloane-Stanley Museum and Kent Furnace, Route 7, Kent 06757 (early American tools and implements)

Delaware

The Hagley Museum, Greenville, Wilmington 19807 (technology, patent models, textile mill)

District of Columbia

National Air and Space Museum, Seventh Street and Independence Avenue, S.W., Washington 20560

National Geographic Society—Explorers Hall, 17th and M Streets, N.W., Washington 20036 (space, aeronautics, technology)

National Museum of History and Technology, 14th Street and Constitution Avenue, N.W., Washington 20560

Smithsonian Institution, 1000 Jefferson Drive, S.W., Washington 20560

United States Department of the Interior Museum, 18th and C Streets, N.W., Washington 20240 (mining, tools)

Florida

Edison Home Museum, 2350 McGregor Boulevard, Fort Myers 33901 (inventions of Thomas Edison)

Hillsborough County Museum, 1101 East River Cove, Tampa 33674

John Gorrie State Museum, Apalachicola 32320 (inventions of John Gorrie)

The John Young Museum and Planetarium, Loch Haven Park, 810 East Rollins Avenue, Orlando 32803 (participatory exhibits and displays, Foucault pendulum, telescope)

Polk Public Museum, 800 East Palmetto, Lakeland 33801

The Science Center of Pinellas County, 7701 22nd Avenue, North, St. Petersburg 33710

Georgia

Atlanta Museum, 537-539 Peachtree Street, N.E., Atlanta 30308 (inventions of Eli Whitney)

Georgia Agrirama, 8th Street at Interstate 75, Tifton 31794 (agricultural and printing equipment, grist mill)

Georgia State Museum of Science and Industry, Room 431, George State Capitol, Atlanta 30334

Gold Hills of Old Dahlonega, Highway 60, Dahlonega 30553 (mining)

Hamburg State Park Museum, Mitchell 30820 (tools and machinery)

Savannah Science Museum, Inc., 4405 Paulsen Street, Savannah 31405 (laboratory exhibit hall)

Hawaii

Bernice P. Bishop Museum, 1355 Kalihi Street, Honolulu 96818 (aerospace)

Idaho

Idaho State Historical Museum, 610 North Julia Davis Drive, Boise 83706 (tools and machines)

Intermountain Science Experience Center, 1776 Science Center Drive, Idaho Falls 83401 (energy)

Illinois

The Adler Planetarium, 1300 South Lake Shore Drive, Chicago 60605 (scientific instruments, timekeeping, navigation, engineering)

Deere and Company, Administrative Center, John Deere Road, Moline 61265 (agricultural technology)

Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago 60605 (textiles, science)

Fryxell Geology Museum, New Science Building, Augustana College, Rock Island 61201 (remote sensing exhibits)

International Museum of Surgical Sciences and Hall of Fame, 1524 North Lake Shore Drive, Chicago 60610

Museum of Science and Industry, 57th Street and Lake Shore Drive, Chicago 60637 (visitor-participation exhibits; technology of many fields)

Telephony Museum, 225 West Randolph Street, Room 21G, Chicago 60521 (telephone technology)

Indiana

Archives and Company Museum—Eli Lilly and Company, Lilly Center, 893 South Delaware, Indianapolis 46206

Discovery Hall Museum, Century Center, 120 South St. Joseph Street, South Bend 46601 (vehicles and products)

Elwood Haynes Museum, 1915 South Webster Street, Kokomo 46901 (satellite invented by Elwood Haynes)

Evansville Museum of Arts and Sciences, 411 S.E. Riverside Drive, Evansville 47713 (transportation, science displays)

Indiana Museum of Transport and Communication, Inc., P.O. Box 83, Noblesville 46060

Whitewater Canal State Memorial, Box 88, Metamora 47030 (milling machinery, tools, grist mill)

Iowa

Des Moines Center of Science and Industry, 4500 Grand Avenue, Greenwood Park, Des Moines 50312

Kansas

Agricultural Hall of Fame and National Center, 630 North 126th, Bonner Springs 66012

Crawford County Museum, 69 Bypass to 20th Street, Pittsburg 66762 (industry and transportation)

McPherson County Old Mill Museum and Park, 120 Mill Street, Lindsborg 67456 (industrial)

Museum of Independent Telephony, 412 South Campbell, Abilene 67410 (telephone technology)

Original Pony Express Home Station, Inc., 809 North Street, Marysville 66508 (steam tractor, threshing equipment)

Stevens County Gas and Historical Museum, 711 Van Buren, Hugoton 67951 (gas industry equipment)

Kentucky

Museum of Natural History and Science, 727 West Main Street, Louisville 40202

Transylvania Museum, 300 North Broadway, Lexington 40508 (scientific apparatus)

Louisiana

Louisiana State Exhibit Museum, 3015 Greenwood Road, Shreveport 71109 (industrial and agricultural technology)

Louisiana State Museum, 751 Chartres Street, New Orleans 70116 (inventive arts)

Maine

Ashland Logging Museum, Inc., Box 87, Ashland 04732 (lumbering equipment)

The Fryeburg Fair Farm Museum, 164 Main Street, Fryeburg 04037 (agriculture)

Maine State Museum, State House, Augusta 04333 (technology)

Maryland

Maryland Academy of Sciences, 601 Light Street, Baltimore 21230 (the inquiring mind, space, energy)

Mount Vernon Museum of Incandescent Lighting, 717 Washington Place, Baltimore 21201

Massachusetts

Crane Museum, Housatonic Street, Dalton 01226 (papermaking)

French Cable Station Museum in Orleans, Corner of Cove Street and Route 28, Orleans 02653 (telegraph cable technology)

Merrimack Valley Textile Museum, 800 Massachusetts Avenue, North Andover 01845 (machinery and technology)

Museum of Science, Science Park, Boston 02114

Museum of Transportation, 15 Newton Street, Larz Anderson Park, Brookline 02146

The National Fire Museum, Edaville R. R., South Carver 02566

Saugus Iron Works National Historic Site, 244 Central Street, Saugus 01906

The Waltham Museum, 194 Charles Street, Waltham 02154 (clocks, radios, tools)

Michigan

Coppertown USA, 101 Red Jacket Road, Calumet 49913 (industrial technology related to copper)

Detroit Science Center, 5020 John R. Street, Detroit 48202 (exhibits in which the audience can participate)

Greenfield Village and Henry Ford Museum, Oakwood Boulevard, Dearborn 48121 (18th–20th century mechanical and industrial arts)

Impression 5, Box 774, East Lansing 48823 (permanent and traveling technology exhibits)

Iron County Museum, Museum Road, Caspian 49915

Iron Mountain Iron Mine, U.S. Highway 2, Vulcan 49892

Ironwood Historical Museum, 226 East Mcleaod Avenue, Ironwood 49938 (iron mining)

Jesse Besser Museum, 491 Johnson Street, Alpena 49707 (tools, machinery, vehicles, Foucault pendulum)

Michigan Historical Museum, Michigan History Division, Michigan Department of State, 505 North Washington Avenue, Lansing 48918 (technology, industry, transportation)

Poll Museum, U.S. 31 and New Holland Street, Holland 49423

The University of Michigan Exhibit Museum, 1109 Geddes, Ann Arbor 48109 (primitive technology)

Minnesota

Bakken Museum of Electricity in Life, 3537 Zenith Avenue, South, Minneapolis 55416

Cook County Museum, Grand Marais 55604 (industrial, agricultural, commercial fishing)

Minneapolis Public Library Science Museum and Planetarium, 300 Nicollet Mall, Minneapolis 55401 (space, ecology, science)

Steamer "Julius C. Wilkie," Levee Park, Winona 55987 (steamboats, technology)

Mississippi

The University Museums, University of Mississippi, University, MS 38677 (scientific instruments)

Missouri

Dunklin County Museum, Inc., 122 College, Kennett 63857 (model engines illustrating power from wind, water, gas, steam, and electricity)

Lead Belt Mineral Museum, Forest and Taylor Avenues, Flat River 63601 (industrial exhibits)

McDonnell Planetarium, 5100 Clayton Road, St. Louis 63110 (space science, Foucault pendulum, seismograph)

Maramec Museum, The James Foundation, Maramec Spring Park, St. James 65559 (scale models, iron works, grist mill, vehicles)

Missouri Town 1855, Jackson County Park Department, Blue Springs 64015 (technology)

Museum of Science and Natural History, Oak Knoll Park, St. Louis 63105 (communications, lighting, technology)

National Museum of Transport, 3015 Barrett Station Road, St. Louis 63122 (technological history of transportation and communication)

Montana

Museum of the Rockies, Montana State University, Bozeman 59715 (technology)

Nebraska

Plainsman Museum, 210 16th Street, Aurora 68818 (inventions)

Nevada

Mackay School of Mines Museum, University of Nevada, Reno 89507

New Hampshire

The Arts and Science Center, 14 Court Street, Nashua 03060

New Jersey

Rutgers University Cook College, Nichol Avenue, New Brunswick 08902 (agricultural machinery)

The Speedwell Village, 333 Speedwell Avenue, Morristown 07960 (factory, telegraph)

U.S. Army Communications-Electronics Museum, Myer Hall, Avenue of Memories, Fort Monmouth 07703 (technological history of military communications)

The W2ZI Historical Wireless Museum, 19 Blackwood Drive, Trenton 08628

New Mexico

Bradbury Science Hall, P.O. Box 1663, Los Alamos 87545

National Atomic Museum, Kirtland Air Force Base East, Albuquerque 87115 (exhibits about current energy programs)

New Mexico State University Museum, Box 3 BV, Las Cruces 88003 (industry and science)

Roosevelt County Museum, Portales 88130 (technology)

Telephone Pioneer Museum, 201 Third, N.W., P.O. Box 1355, Albuquerque 87103 (communications technology)

New York

Antique Wireless Association, Main Street, Holcolm 14469 (radio and communications, electronics, electricity)

Canal Museum, Weighlock Building, Erie Boulevard East, Syracuse 13202 (models, engineering records)

Corning Glass Center, Centerway, Corning 14830 (audio-visual displays, factory tours)

Farmers' Museum, Lake Road, Cooperstown 13326 (machinery and tools, shops, trades)

Glenn Curtiss Museum, Lake and Main Streets, Hammondsport 14840 (aviation history)

The Gregory Museum, Long Island Earth Science Center, Heitz Place, Hicksville 11801

The Greyton H. Taylor Wine Museum, R.D. 2, Hammondsport 14840 (technology)

Hall of Science of the City of New York, Inc., P.O. Box 1032, Flushing 11352 (technology, communications, energy, space, etc.)

International Museum of Photography at George Eastman House, 900 East Avenue, Rochester 14607

The Museum of Broadcasting, 1 East 53rd Street, New York 10022 (radio and television)

Museum of the Printed Word, *The New York Times*, 229 West 43rd Street, New York 10036 (history of printing)

North Shore Science Museum, Science Activity Center, 1526 North Plandome Road, Plandome Manor 11030

Old Water Mill Museum, Old Mill Road, Water Mill 11976 (tools of various trades)

Rochester Museum and Science Center, 657 East Avenue, Rochester 14603 (technology)

Rogers Environmental Education Center, New York State Route 80 West, Sherburne 13460

Salt Museum, P.O. Box 146, Liverpool 13088 (technological history of salt mines)

The Schenectady Museum, Nott Terrace Heights, Schenectady 12308 (technology and electrical industry)

Science Museum, State University Campus, Science Building, Bowers Hall, Cortland 13045 (industry, ecology)

Staten Island Institute of Art and Sciences, 75 Stuyvesant Place, Staten Island 10301 (ecology)

North Carolina

Morehead Planetarium, East Franklin Street, Chapel Hill 27514 (orrery, astronomy instruments, science)

North Carolina Museum of Life and Science, 433 Murray Avenue, Durham 27704 (aerospace, transportation)

Weymouth Woods-Sandhills Nature Preserve Museum, 1386 Southern Pines, Southern Pines 28387 (turpentine industry)

Wright Brothers National Memorial, Manteo 27954

Ohio

Center of Science and Industry of The Franklin County Historical Society, 280 East Broad Street, Columbus 43215 (industry)

Dayton Power and Light Company Museum, Courthouse Plaza, Southwest, Dayton 45401

Frederick C. Crawford Auto-Aviation Museum of The Western Reserve Historical Society, 10825 East Boulevard, Cleveland 44106 (200 vehicles)

Ohio River Museum, Muskingum River at St. Clair near Front Street, Marietta 45750 (river life, ecology, commerce)

Oklahoma

Drumwright Oilfield Museum, East Broadway on Highways 99 and 33, Santa Fe Depot, Drumwright 74030 (oil field history)

Oklahoma Science and Arts Foundation, 3000 Pershing Boulevard, Fair Park, Oklahoma City 73116 (operational science exhibits)

Oregon

Oregon Museum of Science and Industry, 4015 S.W. Canyon Road, Portland 97221 (technology)

Pennsylvania

Ashland Anthracite Museum, Pennsylvania Anthracite Museum Complex, Pine and 17th Street, Ashland 17921 (mining, technology)

Buhl Planetarium and Institute of Popular Science, Allegheny Square, Pittsburgh 15212 (technology, space)

College of Earth and Mineral Sciences Museum, State College 16802 (science and technology)

Cornwall Furnace, P.O. Box V, Cornwall 17016 (industrial, iron mining)

Drake Well Museum, R.D. 3, Titusville 16354 (oil industry)

Franklin Institute Science Museum and Planetarium, 20th and The Benjamin Franklin Parkway, Philadelphia 19103 (industry, technology, space, energy, transportation, etc.)

Hopewell Village National Historic Site, R.D. 1, Elverson 19520 (history of iron industry)

Mutter Museum, College of Physicians of Philadelphia, 19 South 22nd Street, Philadelphia 19103 (development of medical instruments)

Philadelphia Gas Light Museum, 3541 Kensington Avenue, Philadelphia 19134 (history of light)

Pithole, R.D. 2, Pleasantville 17120 (oil industry)

Thomas Newcomen Library and Museum, 412 East North Ship Road, Exton 19341 (history of steam technology)

William Penn Memorial Museum, 3rd and North Streets, Harrisburg 17120 (technology—vehicles, appliances, tools, machinery)

Wyoming Historical and Geological Society, 69 South Franklin Street, Wilkes-Barre 19701 (industrial)

Puerto Rico

La Casa del Libro, Calle del Christo 255, San Juan 00903 (technology)

Rhode Island

New England Wireless and Steam Museum, Inc., Frenchtown Road, East Greenwich 02818 (electricity, communications, steam engines)

South County Museum, Inc., Scrabbletown Road, Box 182, North Kingstown 02852 (technology)

South Carolina

Lexington County Museum, 230 Fox Street, Lexington 29072 (farm machinery, cotton gin)

The Museum, Phoenix Street, Greenwood 29646 (Edison display, operating commercial loom, linotype machine, etc.)

Thornwell Museum, P.O. Box 60, Clinton 29325 (space science)

Tennessee

American Museum of Atomic Energy, Tyrone Road, Oak Ridge 37830 (technology/energy displays)

Tipton-Haynes Living Historical Farm, Erwin Highway 19 West, Johnson City 37601

Texas

Dallas Health and Science Museum, Fair Park, First and Forest Avenues, Dallas 75226 (communications, electricity, industry)

Live Steam Museum, Inc., Route 1, Alamo 78516 (aeronautics, industry, steam engines)

Permain Basin Petroleum Museum, Library, and Hall of Fame, 1500 Interstate 20 West, Midland 79701 (oil industry)

Spindletop Museum, Lamar University, Box 10082, Beaumont 77710 (technological history of petroleum industry)

Texas Forestry Museum, 1903 Atkinson Drive, Lufkin 15901 (logging equipment, scale model paper mill, etc.)

Utah

Fairview Museum of History and Art, 85 North 100, East, Fairview 84629 (engines, machines, vehicles)

Hansen Planetarium, 15 South State Street, Salt Lake City 84111 (technology, space)

Man and Bread Museum, Utah State University, Logan 84321 (agricultural technology)

Vermont

Fairbanks Museum and Planetarium, 83 Main Street, St. Johnsbury 05819 (operating exhibits of machines, electricity)

Virginia

Burwell-Morgan Mill, RFD, Boyce 22620 (mill equipment)

Chesapeake Planetarium, 300 Cedar Road, Chesapeake 23320 (space)

Colonial Williamsburg, Goodwin Building, Williamsburg 23185 (technology of colonial times)

Cyrus H. McCormick Memorial Museum, Steeles Tavern 24476 (technology of farm machinery)

The James Madison Museum, 129 Caroline Street, Orange 22960 (technological development of agriculture)

Monticello, Home of Thomas Jefferson, P.O. Box 316, Charlottesville 22902 (Jefferson's inventions)

National Tobacco-Textile Museum, 614 Lynn Street, Danville 24541 (industrial demonstrations)

North Anna Visitor's Center, Box 402, Route 700, Mineral, Louisa County 23117 (narrated/animated exhibits—electricity generated by nuclear fuel)

Roanoke Valley Science Museum, 2323 Overlook Road, N.E., Roanoke 24012 (aeronautics, space)

Washington

Cle Elum Historical Museum, 301 East 2nd Street, Cle Elum 98922 (technological history of telephone)

Hanford Science Center, P.O. Box 800, Richland 99352 (hands-on exhibits of nuclear and alternative energy)

Museum of History and Industry, 2161 East Hamlin Street, Seattle 98112 (aeronautics, communications, industry, logging, mining, transportation)

Pacific Science Center, 200 2nd Avenue, North, Seattle 98109 (space, physical sciences)

Rocky Reach Dam, P.O. Box 1231, Wenatchee 98801 (Edison collection, powerhouse)

West Virginia

West Virginia State Government, Archives and History Museum, Department of Culture and History, Science and Cultural Center, Charleston 25305 (technological history of lighting)

Wisconsin

Dard Hunter Paper Museum, 1043 East South River Street, Appleton 54911 (technology—papermaking)

MacKenzie Environmental Education Center, Route 1, Poynette 53955 (lumbering, conservation)

Paul Bunyan Camp, Carson Park, Eau Claire 54701 (logging camp, blacksmith)

Platteville Mining Museum, 365 East Main, Platteville 53818

Wyoming

Fort Bridger State Museum, Fort Bridger 82933 (industry, transportation)

Grand Encampment Museum, Inc., Encampment 82325 (transportation, mining)

Guernsey State Museum, Guernsey State Park, Guernsey 82214 (industry, transportation)

Yellowstone National Park, Yellowstone Park 82190 (ecology)

CANADA

Alberta

Man and Telecommunication, 10020 100 Street, Edmonton T6H 0A4 (technology of telephone)

Newcastle Coalminers Museum, P.O. Box 2097, Drumheller T0J 0Y0

Reynolds Museum, Highway 2A, Wetaskiwin T9A 1X7 (transportation, engines, industrial machinery)

Sir Alexander Galt Museum, Community Services Department, West end of 5th Avenue South, Lethbridge T1J 0P6 (technology in development of human history 1860 to present)

British Columbia

British Columbia Farm Machinery Museum Association, 9111 King Street (P.O. Box 279), Fort Langley V0X 1J0

British Columbia Forest Museum, R.R. 4, Drinkwater Road, Duncan V9L 3W8 (logging and transportation)

British Columbia Museum of Mining, P.O. Box 155, Britannia Beach V0N 1J0

Cumberland Museum, P.O. Box 289, Cumberland V0R 150 (medical instruments, mining, iron industry, logging)

Heritage Village, 4900 Deer Lake Avenue, Burnaby V5G 3T6 (industrial machinery)

Kamloops Ranch Museum, Subsidary of Kamloops Museum Association, 207 Seymour Street, Kamloops (agricultural and mining technology)

Lynn Canyon Ecology Centre, 355 West Queens Road, North Vancouver V7N 2K6

Newfoundland

Newfoundland Museum, Duckworth Street, St. John A1C 1G9 (communications, transportation)

Northwest Territories

Northern Life Museum and National Exhibition Centre, P.O. Box 371, Fort Smith X0E 0P0 (history of life)

Nova Scotia

Alexander Graham Bell National Historic Park, P.O. Box 159, Baddeck B0E 1B0 (Bell collection, inventions)

Stellarton Miners Museum, Park Street, Stellarton B0K 1S0 (underground mine)

Ontario

Cobalt's North Ontario Mining Museum, Silver Street, Cobalt P0J 1C0

Elliot Lake Mining and Nuclear Museum, 45 Hillside Drive, North, Elliot Lake P5A 1X5

Gananoque Museum, 10 King Street, East, Gananoque (mail: P.O. Box 293, 133 Sydenham Street, Gananoque K7G 2T7) (industry)

National Museum of Science and Technology, 1867 St. Laurent Boulevard, Ottawa

Oil Museum of Canada, R.R. 2, Oil Springs N0N 1P0 (development of oil industry)

Ontario Science Centre, 770 Don Mills Road, Toronto M3C 1T3 (technology, industry, aerospace, transportation)

Quebec

Alcan Museum and Archives, 1 Place Ville Marie, Montreal (Mail: P.O. Box 6090, Montreal H3C 3H2) (industry, aluminum)

Centre Ecologique, CIP-CIP Nature Centre, R.R. 2, Calumet (science, technology, transportation)

Saskatchewan

Telorama, 2350 Albert Street, Regina 545 2X1 (telephone, satellite, videophone)

Western Development Museum, 1770 Hamilton Drive, Moose Jaw (transportation—rail, air, water, etc.)

Western Development Museum, 2610 Lorne Avenue, South, Saskatoon (agriculture, transportation, industry)

Yukon Territory

Dawson City Museum and Historical Society, P.O. Box 303, Dawson City, Y0B 1G0 (Klondike gold rush)

Part Three: State Humanities Committees

Your community program based on *Connections: Technology and Change* may qualify for funding under the National Endowment for the Humanities. For information about financial assistance and funding guidelines, contact your state committee.

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SECTION FOUR

A Filmography

Introduction

The following list of films was compiled to correlate with the Courses by Newspaper program on issues relating to technology and change. They are arranged alphabetically under each of the course topics; however, since a number of the films would be appropriate under several different topics, we recommend that you read through the entire list before selecting your program.

We have listed the primary distributor (the sales source) for most of the films. Many of these films may also be available free from your local public library, or for a modest rental fee from a university film rental library.

For those who want guidance on setting up film discussion programs, we recommend *Leading Film Discussions: A Guide to Using Films for Discussion, Training Leaders, Planning Effective Programs,* by Madeline S. Friedlander, published by the League of Women Voters, 817 Broadway, New York, NY 10003. Price: $1.50. A list of additional sources of information on related films follows the film listings.

For more information on locating and using films, programmers can contact the Educational Film Library Association, 43 W. 61st St., New York, NY 10023. Telephone: (212) 246-4533.

Compiled by the Educational Film Library Association, Inc.

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The Poetry of Technology

Since the early days of cinema when the Lumière Brothers filmed a "Train Arriving at the Station" (and frightened uninitiated audiences), filmmakers have been fascinated by technological processes. The rhythms of machines in motion seem to lend themselves to cinematic treatment. Here is a selection of short, poetic visual essays which can be used to open a program of technology films.

Glass, 11 min., color, 1958. Director: Bert Haanstra. Distributor: McGraw-Hill Films.

The handcrafted work of the glassblower and the mechanized assembly line process of bottle production are contrasted in this lyrical, humorous study. —N.C.

Metroliner, 35 min., color, 1975. Director: Victoria Hochberg. Distributor: Victoria Hochberg.

A visual essay on the Metroliner—the fast train between New York and Washington, D.C.—that takes the viewer behind the scenes to provide insight into the operations of a railroad. —N.C.

100 Watts, 120 Volts, 6 min., color, 1977. Director: Carson Davidson. Distributor: Pictura Films.

The camera captures a symphony in motion as a complex machine creates light bulbs (apparently unaided by human hands), to the accompaniment of the third Brandenburg Concerto. —N.C.

Penny Lane, 10 min., color, 1975. Director: Arnold L. Leibovit: Distributor: Penny Lane Films.

In the 19th century when technology reigned unquestioned, even the folk art reflected a fascination with mechanical processes. Here, we see a series of rare antique toy mechanical banks in operations. —N.C.

Railroad Turnbridge, 19 min., b&w, silent, 1976. Director: Richard Serra. Distributor: Castelli-Sonnabend.

A noted steel sculptor uses the film medium to choreograph the motions of camera and editing with the movements of a railroad turnbridge, creating a fascinating study of motion, line, and form. —N.C.

Treadle and Bobbin, 9 min., color, 1954. Director: Wheaton Galentine. Distributor: Film Images.

An old-fashioned treadle sewing machine serves as the inspiration for a rhythmic visual interpretation of movement and color. —N.C.

CONNECTIONS: Ten-Part Program Series

Connections, 52 min. each, color, 1979. Producers: BBC-TV & Time-Life Films. Distributor: Time-Life Multimedia.

The keynote 10-part series (available in both 16mm and video formats) in which journalist and BBC-TV host James Burke examines how apparently unrelated events, people, and situations have come together to produce social and technological changes. Programs in this series, which tie in with topics in Courses by Newspaper, are: **The Trigger Effect; Death in the Morning; Distant Voices; Faith in Numbers; The Wheel of Fortune; Thunder in the Skies; The Long Chain; Eat, Drink and Be Merry; Countdown;** and **Yesterday, Tomorrow and You.**

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1 Technology on Trial

But Is This Progress?, 51 min., color, 1973. Producer: NBC-TV. Distributor: Films Inc.

Once symbols of progress, the car and the smokestack are now often symbols of pollution and destruction. This thought-provoking documentary takes a look at how technology affects three generations of people in San Jose, California: a couple in their seventies, an affluent middle-aged couple who grew up during the Depression, and a young woman in her early twenties. Emphasizes the point that technology doesn't always bring happiness. —C.A.E.

Butterfly, 4 min., color, 1975. Director: Nico Crama. Distributor: Carousel Films.

To the accompaniment of a modern music track, but without dialogue or narration, this film opens on a verdant meadow in which a butterfly flits from flower to flower. More and more buildings and man-made structures appear with the resultant urban blight, until all that remains is the butterfly—which has become a specimen framed on a museum wall. Animated. —J.M.

The Day the Earth Caught Fire, 90 min., b&w, 1962. Director: Val Guest. Distributor: Audio Brandon Films.

The ill-effects of nuclear testing have been dramatized in imaginative fashion in several superior science fiction films. In **The Day the Earth Caught Fire,** simultaneous explosions at the North and South poles have shifted the earth's orbit and sent it hurtling toward the sun. Scientists seeking a new energy source create a **Crack in the World** (96 min., color, 1965. Director: Andrew Marton. Distributor: Paramount) when they explode a bomb at the earth's core. Ants enlarged by radiation from atomic testing become **Them!** (94 min., b&w, 1954. Director: Gordon Douglas. Distributor: Audio Brandon Films) and menace Los Angeles. On the other side of the coin is **The Incredible Shrinking Man** (81 min., b&w, 1957. Director: Jack Arnold. Distributor: Universal/16) who, after passing through a radiation cloud, winds up wielding a sewing needle in a battle with a spider over a bread crumb. —B.C.

The Mystery of the Anasazi, 53 min., color, 1973. Producer: WGBH-TV, Boston. Distributor: Time Life Multimedia.

A tour of archaeological sites and digs in the Four Corners area of the United States (where the states of Arizona, New Mexico, Colorado, and Utah meet). It was here, from approximately 650 to 1300 A.D., that the Basket Makers and the Stone Age People of the Anasazi created North America's first known example of urban living, with an advanced form of architecture, an impressive system of roads, and a non-belligerent, peaceful lifestyle that surpassed anything in northwest Europe at the time. Yet, the Anasazi people had no known writing, no metal tools, no wheels or draft animals. The film reaches the conclusion that the people may have used up all their natural resources and been forced to leave their land. Speculates on the problem of rapid population growth and resultant cultural changes, and then draws a moral and message for today. From the *Nova* series. —J.M.

2001: A Space Odyssey, 138 min., color, 1968. Director: Stanley Kubrick. Distributor: Films Inc.

A painstaking, serious look at space travel at the turn of the next century. The most elaborate, yet least fanciful, film of its type. Foreshadowing **Star Wars,** the astronauts display less human characteristics than does the ship's computer, HAL 9000. In **Star Wars** (121 min., color, 1977. Director: George Lucas. Distributor: Films Inc.), the ultimate technological movie, what the good guys fight for isn't as important as what they fight with. Astonishing, unprecedented special effects tell a hardware-heavy story of planet-hopping rebels dodging imperial cruisers in their quest to free a rebel princess held captive in the Death Star, HQ of the Galactic Empire. The robot characters steal the show. —B.C.

Urbanissimo, 6 min., color, 1970. Director: John Hubley & Faith Hubley. Distributor: Films Inc.

The Hubleys' animated impression of a city: a satirical portrait of a jumble of buildings and blocks on legs invading the countryside, exploiting our natural resources, destroying mountains, draining oil, polluting duck ponds, and technologically improving things in ways that earn a farmer an eggbeater for his eggs and canned fruit for his fresh produce. When crisis strikes, the city's legs are innovatively replaced with wheels. —M.C.

Why Man Creates, 25 min., color, 1969. Director: Saul Bass. Distributor: Pyramid Films.

Animation, trick photography, symbolism, surrealism, and humor present the essence of inventiveness through time and from several points of view. Useful to relate technological practice and need to the individual's inherent power to solve problems as they are imperfectly perceived, in an organized and (sometimes) haphazard process. —S.J.

2 Silent Revolutions

China: The Beginnings, 19 min., color, 1977. Director: Wan-go Weng. Distributor: Indiana University, Audio-Visual Center.

Covers the beginning of Chinese civilization, concentrating on the Shang Dynasty (18th–12th centuries B.C.). Touches on the birth of the science of astronomy in China and the development of pictographs and ideographic writing. —J.M.

Henry Adams: Historian (1870–1885), 60 min., color, 1976. Producer: WNET/13. Distributor: Indiana University, Audio-Visual Center.

Dramatic film that highlights the controversies surrounding railroad magnates and the radical labor movement, which pushed Henry Adams and Charles Francis Adams II into reform. In this film, Henry becomes a successful writer of satire. From *The Adams Chronicles* series. —J.T.

Homespun, 22 min , color, 1952. Producers: Elmer Albinson & Harry Webb. Distributor: International Film Bureau.

A robust, elderly Minnesota farm wife uses relic tools and methods native to her Swedish homeland to highlight each step in the weaving process—from shearing her Angora goat, carding the wool, spinning the wool on an old wheel, washing and dyeing (natural) and drying (sun) the wool, weighing and winding the yarn, and finally weaving. In the end, various woven goods are displayed with much pride. Although filmically static, the demonstration (done totally out-of-doors) is straightforward enough to enhance the skills involved in the ancient craft of weaving. —J.T.

The Medieval Mind, 26 min., color, 1969. Director: John Barnes. Distributor: Encyclopaedia Britannica Educational Corp.

Presents the paradox of the medieval culture. Religion was a unifying force, as evidenced by the artwork and magnificent cathedrals built in Western Europe during the period. Concurrently, advances in agriculture (the invention and utilization of horseshoes, wheeled plows, the harness), and in other fields (stirrups for the cavalry, eyeglasses) were introduced, thereby altering the role of man in his culture. Secular values began to replace religious ideas as the technological innovations produced the beginnings of "leisure time." The film's structure is weak, but it can be used to provoke discussion of attitudes toward change. —J.R.

Old Treasures from New China, 55½ min., color, 1977. Producer: Shirley Sun. Distributor: University of California, Extension Media Center.

A careful, detailed history of the development of Chinese civilization, from its beginnings to the 18th and 19th centuries A.D., lavishly illustrated with footage of an archaeological exhibit sent to the U.S. in the 1970s by the People's Republic of China. Illustrates the evolution of civilization and the development of aesthetic awareness in China beginning with the Stone Age and the invention of hand tools. In the 6th century A.D., the influx of nomadic tribes also carried with it the growing importance of women in Chinese society, as well as the flourishing of international trade through the camel caravans' contact with the West. The Rebellions in the 10th through 13th centuries A.D. brought to China movable printing, the compass, and gunpowder. —J.M.

Woman Is, 12 min., color, 1975. Director: Sandy Ostertag. Distributor: Phoenix Films.

The roles and perceptions of women as mothers, lovers, workers, and wives from ancient times to the present are reflected in approximately 400 stills of sculpture, paintings, drawings, photographs, and, more importantly, ads. A good introductory film. For an American focus, see **The Emerging Woman** (40 min., b&w, 1974. Producer: Women's Film Project. Distributor: Film Images), which is a carefully researched economic, social, and cultural history of women in the United States from colonial times to the present. The accomplishments of well-known women are noted, and excerpts from their writing are read. These excerpts reveal how they fought against discrimination and how they tried to dispel myths about women, especially the "feminine mystique." —C.A.E.

A Woman Rebels, 88 min., b&w, 1936. Director: Mark Sandrich for RKO. Distributor: Films Inc.

Independent-minded Pamela Thistlewaite (Katharine Hepburn) believes she has a right to choose her own destiny, but finds herself at odds with her 19th-century times. She battles her father, falls for a weak lover, raises a child out of wedlock, and insinuates herself into a writing/editorial position on a magazine; while stoic Herbert Marshall encourages, hopes, and waits on the sidelines. **My Love Has Been Burning (Waga Koi Wa Moenu,** 84 min., b&w, 1949. Director: Kenji Mizoguchi. Distributor: New Yorker

Films) features her Japanese counterpart: a young woman who leaves her family home in the late 19th century to study and work in Tokyo and who gets involved in a game of politics and the politics of sex. —M.C.

Woman: Who Is Me?, 11 min., color, 1978. Director: Judith Keller. Distributor: Focus International.

Examines how the myths about women's roles have persisted through the centuries by focusing on their images in well-known works of art. —J.T.

3 How Terribly Technical!

Babbage's Calculating Machine or Difference Engine, 4 min., color, 1968. Directors: Charles Eames & Ray Eames. Distributor: Pyramid Films.

A brief visual essay on Babbage's calculating machine —the forerunner of today's electronic computer. Opens with a view of the mechanical apparatus of the calculating machine (difference engine) actually operating, with a narrator reading the inventor's original directions for how to use the machine. Excellent for visualizing a complex machine that is relatively simple compared to today's modern computers. —C.S.

Cracking the Stone Age Code, 52½ min., color, 1973. Producer: BBC-TV. Distributor: Time Life Multimedia.

Alexander Thom, 76-year-old Professor Emeritus of Oxford University, discusses his theory of ancient astronomers in Britain and Europe. He believes that in 1800 B.C. (almost 4,000 years ago), there existed men in Europe who could make solar and lunar predictions with great accuracy. He thinks that these men invented the "megalithic yard" of 32.64 inches, which they then employed in multiples of ten to measure triangles, circles, etc., and then set up huge stone boulders or megaliths on the ground. These stones, which still stand—including the famous Stonehenge monuments—served as physical landmarks to construct accurate, practical, and theoretical engineering and astronomical systems. Two centuries later, these same findings were rediscovered by Pythagoras in Greece, and still later by Galileo in Italy. For more on Stonehenge, see also **In Search of the Magic of Stonehenge** (24 min., color, 1976. Distributor: Pyramid Films), which speculates on the methods of placing the enormous blocks of stone and their function as an astronomical observatory and calendar. —J.M.

The Lost World of the Maya, 38½ min., color, 1972. Producers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Examines the glory of the classic period of the ancient Mayan civilization. Highlights its heyday (from 300 to 900 A.D.) and extermination (by the mid-17th century) at the hands of the Toltecs and Spanish conquistadors. The civilization was based on the significance of each day of the year. The sophisticated Mayan civilization had its own form of writing, and its many scholars dealt with abstract concepts such as "zero," the measurement of time, and the length of eternity. With Dr. Eric Thompson. From the *Nova* series. —J.M.

The Music of the Spheres, 52 min., color, 1974. Director: Adrian Malone for BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Traces the development of mathematics from the Grecian period through the Renaissance, highlighting the effects of the Christian and Moslem religions on its development. Takes the viewer to each major location—Greece, Alexandria, Spain, and Italy—where Dr. Jacob Bronowski discusses the developments of a given period. From *The Ascent of Man* series. —C.S.

Nicholas Copernicus, 10 min., color, 1973. Directors: Charles Eames & Ray Eames. Distributor: Pyramid Films.

A visual essay showing the environment in which Nicholas Copernicus, founder of modern astronomy, lived and worked. The viewer travels with Copernicus as he moves from city to city during his lifetime. Provides the viewer with a real sensitivity to the life of Copernicus. —C.S.

The Starry Messenger, 52 min., color, 1975. Director: Adrian Malone for BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Explores the origins of astronomy and compares the Ptolemaic view with that of Copernicus as proved by Galileo's experiment with the telescope. Considerable emphasis is given to the conflict of Galileo's research with religious thought of the day. Shows the increasing complexity of scientific thought and the rejection of the new concepts by the established social institutions of the period. From *The Ascent of Man* series. —C.S.

4 Occupational Destinies

A Nous la Liberté, 87 min., b&w, 1931. Director: René Clair. Distributor: Corinth Films.

René Clair's arch comparison of prison life to the regimentation of the factory line. Escaped prisoner Émile (Henri Marchand) crosses the path of his old chum and partner Louis (Raymond Cordy) who is now a wealthy manufacturer of phonographs. For old times' sake, Louis gives Émile a job in the plant, but little Émile has tasted freedom and can't conform to the monotonous routine of the line. The fairy tale ending with the workers taking over the factory and upgrading the equipment so machines do all the work is a strong pro-technology statement, but the laborers' heavenly vision of leisure is anything but out-of-this-world. —M.C.

Factory, 55 min., b&w, 1970. Producer: Arthur Barron. Distributor: Filmmakers Library.

This cinéma vérité visit to a jewelry factory in Brooklyn painfully reveals the boredom and alienation of the line workers. The blue collar workers are trapped and, therefore, without hope. **They Want to Make Work Human Again** (17 min., color, 1973. Producer: NBC-TV. Distributor: Films Inc.) also shows how the monotony of the assembly line frustrates factory workers. At Volvo and Saab auto plants, they are experimenting with small work teams. Likewise, a Gaines Dog Food plant set up teams in charge of the total production, and the Virginia Bell System gave installers their own territories. This film takes a brief look at the newest ways of organizing work for increased productivity and employee satisfaction. **The Four Day Week** (17 min., color, 1967. Producer: CBS-TV News. Distributor: McGraw-Hill Films) explains how automation, labor unions, and early retirement are causing shorter work weeks and examines the benefits and problems that result. The film also takes a look at "leisure" industries. Narrated by Walter Cronkite. —C.A.E.

From Spikes to Spindles, 50 min., color, 1976. Director: Christine Choy for Third World Newsreel. Distributor: Third World Newsreel.

A somewhat schizophrenic production which aims to strengthen the Chinese-American image outside of and within the Chinese-American community today. Of relevance here because it touches not only on the historic brutalization of coolie labor during the Western expansion of the United States, but also on the growing numbers of Chinese-American women now employed in New York City's garment factories, where they are apparently the major immigrant group. Smashes the Chinese-American stereotype of passivity by including anti-discrimination protest and job marches, unionizing and better wage discussions, and talk of the spread of the garment and other light industry within New York's Chinatown. —J.T.

Going Out of Business, 15 min., b&w, 1977. Director: Christopher Gamboni. Distributor: Christopher Gamboni.

Briefly traces (through voice-over narration and reminiscence) the rise and fall of the Griswold Machine Works (film splicers), a family-owned and operated shop in Port Jefferson, New York. The film records the shop's last days, with its few remaining elderly workers on hand to complete one last job. All are dedicated to the company and face forced retirement with much sadness. The splicers were each essentially handmade by highly skilled workers—now too rare and expensive to make the business viable. Basically a moodpiece and lament for the end of the family shop, individually crafted products, and skilled machinists who care. —J.T.

The Industrial Revolution in England, 26 min., color, 1959. Producer: John Barnes. Distributor: Encyclopaedia Britannica Educational Corp.

Prior to the Industrial Revolution in Great Britain, textiles were produced according to the "domestic system," i.e., spinning and weaving were carried out in a Master's cottage, where weaver apprentices or journeymen worked and lived, hand crafting each and every product. As a result, no great quantities of products were produced, and workers were not much better off than serfs. In the space of 100 years, however, the invention of the spinning jenny, power loom, and steam engine transformed Britain from an agrarian society to an industrial leader—a land of cities, bustling mills, and exploitation of workers. This traditional educational film personalizes its lesson with dramatization and animation, making the historical transformation and discovery of the three singular inventions a palatable experience.

A companion film, **The Industrial Revolution: Beginnings in the United States** (23 min., color, 1968. Producer/Distributor: Encyclopaedia Britannica Educational Corp.) is not as successful a film, but it does cover the importance of water power, Samuel Slater's first textile mill (from his British model), and Eli Whitney's innovation of interchangeable parts (muskets) in the move from a bucolic farming nation to a land of cities and factories in the space of 50 years.

Although discussed at length elsewhere in this filmography (see section five), **The Drive for Power,** from *The Ascent of Man* series (52 min., color, 1973. Pro-

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ducers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia), is by far the best, most successful film on the Industrial Revolution in Britain. J. Bronowski's lucid examination of the larger implications of the Industrial Revolution, taking into account everything from almighty water power, the rise of mills and factories, Wedgwood, to the beginnings of automation, etc., is fascinating.

For information on the famous pottery company, see **Wedgwood** (17 min., color, n.d. Producer/Distributor: Golden Films). —J.T.

Inheritance, 31 min., color, 1974. Director: Jack Ofield. Distributor: Bowling Green Films.

A documentary comparing the work of three artisans and three modern assembly lines, producing approximately the same items. The craftsmen—a shovel maker, a basketmaker, and a tinsmith—take great pride in their work. In contrast, the assembly line workers have no opportunity to become involved with their work. During each vignette on a craftsman, the background sounds are very calm and serene; during the manufacturing scenes, the soundtrack becomes very loud and irritating. The auditory and visual dissonance of the manufacturing lead the viewer to reject modern methods as being irritating and impersonal. —C.S.

Modern Times, 89 min., b&w, 1936. Writer/Director/Star: Charles Chaplin. Distributor: Paramount Pictures Corp.

Perhaps Chaplin's finest social comment, this satire exposes the effects of mass production—automation, assembly line technology—on the sanity of the factory worker. The imaginative worker who tries to project a bit of his own personality "on the line" is quickly and literally chewed up and spit out by the system; while the worker who marches in step with the rest of the flock has an easy, if dull, time of it. —J.T.

On the Line, 50 min., color, 1976. Director: Barbara Margolis. Narrator: Rip Torn. Distributor: Cine Information.

Ominous, but comprehensive overview of critical problems existing within the American economy today, i.e., rising prices (housing, food); job cutbacks; general unemployment; tedium and powerlessness on the job, etc. The film is unsparing in its catalog of woe: men who are laid off jobs at advanced ages; women and minorities (the last hired, the first fired) who must work menial jobs to support their families; professionals (in this case, an engineer) who are merely skilled tradesmen, pigeonholed into one corner of a profession that once offered numerous opportunities. However, a glimmer of hope shines through. Low-income people are banding together to fight the system. A year-long Co-op City rent strike in Bronx, New York, is supported by both young and old residents of 35 buildings; a 1975 March for Jobs in Washington, D.C., pushes to keep jobs out of the hands of cheap labor (Japan and the South); and a representative from United Black Workers (Ford Motor Company) discusses his ideas about shorter work weeks and ways to give workers more dignity on the job. —J.T.

Song of the Canary, 58 min., color, 1978. Directors: Josh Hanig & David Davis. Distributor: Manteca Films.

Canaries—fatally sensitive to carbon monoxide gas—were once carried into the mines to warn miners of the presence of the deadly gas. As this film points out, workers are still not immune to industrially related disease and death. Focuses on a California chemical plant where workers have become sterile from a farm pesticide they manufacture. Also shows retired cotton mill workers who suffer brown lung disease (from cotton dust), and who are fighting the government and the mills for compensation and safer working conditions. Action and lack of action by employers, unions, and the government are noted. —J.T.

Union Maids, 48 min., b&w, 1976. Directors: Jim Klein, Miles Mogulescu, Julia Reichert. Distributor: New Day Films.

Interviews with three women who were militant union organizers during the Thirties highlight the horror of pre-union labor conditions in America, especially for women and minorities, and the work of such militants to change conditions. Much use of rare newsreel footage and labor songs of the period, which are also well-used in a second excellent documentary, **With Babies and Banners: Story of the Women's Emergency Brigade** (46 min., color and b&w, 1978. Director: Lorraine Gray. Distributor: New Day Films). In this film, Flint, Michigan, women (workers, as well as wives, sweethearts, and sisters of workers), who were directly involved in the 1937 General Motors sit-down strike, speak out about inhuman conditions in the plant and their courageous, often degrading efforts to support the strike and better their lives. What makes this film so moving is the fact that these women were not radicals. They were fighting to keep food on their tables and their husbands alive to eat it. —J.T.

Waterground, 16 min., color, 1977. Director: Frances Morton. Distributor: Appalshop Films.

A tribute to a 100-year-old water-powered North Carolina grist mill, operated by a descendant of the original operator. Walter Winebarger talks about his

work, the natural flour he provides (no bleach, no chalk), and his business today vs. the mill's 24-hour-a-day, six-day-a-week business in the Twenties. He grinds flour and meal using a method little changed from the process used by five generations of Winebargers. The mill operates in a lush, natural setting, which is contrasted with the interior of an automated General Mills plant in Johnson City, Tennessee. The GM flour is mass processed and packaged in sterile, inhuman surroundings. An executive talks about electricity, speed, and big profits. Winebarger enjoys small profits, but immense satisfaction from his work. —J.T.

5 Culture: The Link Between Nature and Technology

Boomsville, 11 min., color, 1969. Director: Yvonne Mallette. Distributor: Learning Corp. of America.

A new world. An explorer arrives at the virgin shore. The forest disappears; an early settlement is established; development continues. The Industrial Revolution, bridges, conduits, row upon row of houses become parking lots, fast food stores, war, factories, leisure pastimes, controlled environments, frenzy and confusion evolve rapidly. What next? Extending beyond his earthly boundaries, man arrives on a distant planet; the natives make a hasty retreat as the process begins anew. This animated film produced by the National Film Board of Canada makes a timely statement about the limits of the earth's resources and man's relentless pursuit of bigger and better. —J.R.

A City at Chandigarh, 51 min., color, 1977. Director: Alain Tanner. Distributor: New Yorker Films.

When Chandigarh was designed, numerous cultural and environmental factors were considered. The inexpensive building material (brick) determined the low height of the buildings. The extreme variations in daily temperature and seasonal climate necessitated specific structural elements, e.g., sun breakers designed to admit the low winter sun, while still being able to block the high summer sun; and terraces or roofs for outdoor sleeping in the summer. This modern city was built by hand by the people who live in the neighboring village. An interesting and well-developed film studying the people, their work, and their relationship to their cultural environment, and contrasting Le Corbusier's city in the Indian desert with the traditional village only a half-mile away. Good to use for a discussion of the comparative uses of technology in a specific climate arrangement. —J.R.

Dawn of the Solar Age I: Solar Energy, 29 min., color, 1977. Producer: Edward Goldwyn. Distributor: Time Life Multimedia.

Dawn of the Solar Age II: Wind and Water Energy, 25 min., color, 1977. Producer: Edward Goldwyn. Distributor: Time-Life Multimedia.

We live in a technologically advanced culture with ever-increasing demands for energy. Will we turn to nature to satisfy these needs? These two films, which can be used either consecutively or individually, clearly present the developing technologies harnessing energy from nature. Superb photography, fine animation, charts, diagrams, and clear presentation detail the efforts to convert, store, and use energy from the sun, wind, or water. Explains the efficiency of these energy sources and the problems inherent in each. From the *Nova* series. —J.R.

Down to Earth City Living, 18 min., color, 1977. Director: Joaquin Pablo. Distributor: Pyramid Films.

Increased awareness of the limits of the physical, organic, and cultural elements of this world has prompted a variety of alternative answers to the problems created, in part, by non-stop technological advances. This film depicts a self-reliant household in Berkeley, California (the Integral Urban House). Shows use of solar energy for heat and hot water; growing vegetables and raising chickens and rabbits for food; utilizing wastes as fertilizers and the process of converting them into usable soil supplements. In this age of advanced technology, "back to earth" living is becoming more popular. Film should promote discussion on the way technological innovations have placed man once more on intimate terms with nature, and the possibilities of cultural adaptations as a result of these innovations. —J.R.

The Drive for Power, 52 min., color, 1973. Director: David John Kennard for BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Jacob Bronowski classes the Industrial Revolution as a social one (as were the American and French Revolutions). Begun in the countryside, with inventions like the water mill to provide energy, it was a revolution of the "practical," not the educated man; the inventions and innovations were designed for everyday use. (The Swiss and French, however, used technological advances to create expensive clocks and mechanical toys.) Film shows the increasing understanding of nature as a carrier of energy (Franklin's

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experiments with electricity). Man moves from farm laborer to industrial worker. Canals and railroads were instituted; increased use of iron created the iron bridge. Explains that all aspects of man's culture—even literature—were affected by the changes occurring with this new awareness of nature and the resultant technological innovations. Provides a view of the interrelatedness of man, nature, and technology. From *The Ascent of Man* series. —J.R.

The Harvest of the Seasons, 52 min., color, 1974. Producers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Among other things, Jacob Bronowski covers man's domestication of plant and animal life, and how the Neolithic cultivators surfaced with the nomads and the roots of warfare. From *The Ascent of Man* series. —J.T.

Land, 26 min., color, 1976. Producer: Playback Associates for Phillips Petroleum. Distributor: Modern Talking Picture Service.

Traces the facts and factors behind the use of American land from the discovery and eventual conquest of the wilderness to our modern agribusiness. The growth of our country sometimes resulted in mistakes such as farming too extensively in one area. The use of our land was affected by the McCormick reaper, the Case thresher, the gas tractor and the refrigerated railroad car. From the *American Enterprise* series. —C.A.E.

Louisiana Story, 77 min., b&w, 1948. Director: Robert Flaherty. Distributor: McGraw-Hill Films.

A classic by the noted director of **Nanook of the North,** this dramatization, sponsored by Standard Oil, presents a romanticized version of the beneficial impact of technology. The story focuses on a young Cajun in the bayous of Louisiana and the changes that occur in the lives of his family as a result of the discovery of oil in the region. Music by Virgil Thomson. —N.C.

Pakistan: Mound of the Dead, 27 min., color, p. 1972, r. 1977. Producer: Chatsworth Film Distributors, Ltd. Distributor: Centron Films.

Celebrates a remarkable civilization that flourished around 2000 B.C. The so-called Indus Civilization existed (and perished) long before that of ancient Greece, and endured longer than that of ancient Rome. The center of the Indus Civilization was the thriving, one-mile-square city Mohenjo-Daro, with its intricate drainage system and skyscrapers. Carefully built to a master plan, Mohenjo-Daro is described as "1984 B.C." by one modern historian.

The film explains the civilization and its demise, hypothesizing that its foremost industry—the making of bricks—was also its undoing, because it provoked the people into decimating their natural resources, e.g., trees. The resultant soil erosion caused life in the area, and eventually the civilization itself, to be dispersed and abandoned. Contains an implicit moral for today. —J.M.

Yellow Trail from Texas, 50 min., color, 1975. Producers: BBC-TV & BR/Telepool. Distributor: Time Life Multimedia.

Documents an American harvesting crew—Dale Starks, his wife, and about a dozen hired hands and their wives. They begin in early May and work 14 to 18 hours a day until late September, using the latest in giant, mechanized threshers and harvesters. They cut wheat, grain, and birdseed, from Texas to Saskatchewan. Emphasis is on the men, their wives, their machinery, and the long, hard work; but peripherally, it also takes a historical look at the development of wheat as an industry and way of life in the American Plains states, i.e., how the states developed, and how agriculture changed with the use of heavy machinery. Also points out the importance of American wheat in the world economy. —J.M.

6 The Influence of Societal Values

The Amish: A People of Preservation, 52 min., color, 1976. Director: John L. Ruth. Distributor: Encyclopaedia Britannica Educational Corp.

A portrait of the Amish community: their families, religion, work, and lifestyles. Emphasizes their simple needs and how they adapt to a world of technological change.

Automania 2000, 10 min., color, 1961. Director: John Halas. Distributor: McGraw-Hill Films.

A whimsical cartoon on technology gone wild. The cars multiply, grow larger, become more and more complicated until the engineers create the ultimate auto: one that reproduces itself. —C.A.E.

Auto-Mates, 22 min., color, 1978. Director: Gary A. Walkow. Distributor: Gary A. Walkow.

A husband and wife, returning from a Sunday visit, discover that they are trapped inside their car. For two days and nights, we follow their odyssey—through filling stations, drive-in restaurants, and drive-in movies—into a state of delirium and hallucination. A satire on our automotive society, the film is shot entirely within the confines of the automobile. —N.C.

Bate's Car, 16 min., color, 1975. Director: Tony Ianzelo. Distributor: Arthur Mokin Productions.

A provocative documentary of Harold Bate's creative answer to the threats of pollution and fuel shortage, through the invention of an automobile that runs on common barnyard manure. Useful to stimulate inquiry and a second-look attitude toward commonly accepted technological limitations. Attractive, humorous, humane treatment. —S.J.

Cities for People, 49 min., color, 1975. Directors: Amanda Pope & John Louis Field for KPBS-TV. Distributor: University of California, Extension Media Center.

An appeal for giving cities back to the people. Examines space—sidewalks, steps, walls (buildings, windows, arcades), ceilings (awnings, glass umbrellas, trees)—and how that space is used in cities to make habitable human environments. The glass-roofed Galleria in Milan, the river walk in San Antonio, the trees and fountains of the Savannah squares, the Cannery in San Francisco, the Peach Tree Plaza in Atlanta, the pedestrian walkway in Perugia, all with human-scale spaces, are contrasted with the dehumanized Wall St. space. Presents a strong argument for changing our priorities and planning cities and spaces that will embrace the best of history, tradition, and technology and yet accommodate the needs of people. A film that works well in counterpoint is **Brasília** (13 min., color, 1961. Producer: George Tamarski. Distributor: International Film Bureau), a pedantic documentary on the building of the new Brazilian capital, a stark, dehumanized city on a monumental scale. —M.C.

Genevieve, 86 min., color, 1954. Director: Henry Cornelius. Distributor: Walter Reade 16.

"Our heroine" is a 1904 Darracq roadster which John Gregson loves more than anything else in this world, except maybe his wife, Dinah Sheridan. They squabble over whether they should go to a party or make the annual London-to-Brighton antique car commemoration race. The race wins out and a "friendly" rivalry between "Genevieve" and Kenneth More's antique sports car flourishes—encompassing breakdowns, quick road repairs, sabotage, and name calling. An homage to old cars and the pride of man in his machine. —M.C.

Geopolitics: The Shape of Things to Come, 20 min., color, 1972. Director/Writer: Clifford Solway for Hobel-Leiterman Productions. Distributor: Document Associates.

Focuses on rapid technological changes, how well man adapts, and whether man is in control of events or merely conforms to the way things are. Economist Robert Heilbroner, author of *The Future as History,* points out that the practical American approach to technological questions is "if you can do it, do it," and that we seldom ask if we should do it. He defines the major problems man will have to face and solve—the threat of nuclear annihilation and the destruction of the environment. Arnold Toynbee stresses the need to control population and to foster the growth of an international community. —M.C.

Henry Ford's America, 57 min., color, 1977. Director: Donald Brittain. Distributor: National Film Board of Canada.

Traces the history of the car and its mass appeal from its Model T ("the little black box that could run forever") origins to its present-day ten-million-cars-a-year production level. Somewhere along the way, the puritan ethic behind Henry Ford's idea to manufacture a practical, economical means of transportation, which would put the country on wheels, got sidetracked by an obsession with the profit motive. Car packaging became fancier, and the utility of the car got confused with glamour and other indicators of upward mobility. The assembly line, meanwhile, got

drearier and more demeaning and laborers organized. Henry Ford II revived the Ford Motor Co. and pushed it into high-scale production and a competitive position with GM. But with increased production came problems—consumer complaints and warnings about the safety hazards of the automobile. Includes a satirical look at custom-made cars and a church service at a Drive-In Sanctuary that only Evelyn Waugh could have invented. —M.C.

Power and Wheels: The Automobile in Modern American Life, 17 min., color, 1972. Producer/Director: William Kay. Distributor: Encyclopaedia Britannica Educational Corp.

Explores America's love affair with the automobile, including its original benefits of providing cheap transportation, shortening geographical distances, and obscuring social distinctions. The automobile is so closely tied to the economy that one out of six members of the work force is engaged in an automobile-related service. Like an uncontrolled monster, the automobile has even defaulted on its promise of escape: the millions of cars on the road and the endless traffic jams make escape impossible. —M.C.

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7 Technology, Population, and Resources

Awakenings, 45 min., color, p. 1973, r. 1977. Producer: Duncan Dallas. Distributor: International Rehabilitation Film Review Library.

The influenza epidemic of 1918 had devastating consequences in worldwide mortality and ongoing morbidity. This remarkable film shows Dr. Oliver Sachs working with some of those persons crippled with post-encephalitic disease. They are briefly helped by a new drug, and their plight raises medical issues that reflect worldwide health problems. —E.M.

The Body Human: The Miracle Months, 50 min., color, 1977. Director: Alfred Kelman. Distributor: Trainex Corp.

One reason for the continuing increase of our population is better prenatal care. Successes with difficult pregnancies have been aided by advanced in the medical sciences. This film studies the techniques doctors use, assisted by new monitoring machines, in three pregnancies with different medical complications. Treatment is clearly explained, enhanced by diagrams; contains excellent footage of the fetuses developing in the womb. Narration, at times, romanticizes the role of woman/mother, but the photography and structure compensate. —J.R.

Farming and the Land, 29 min., color, p. 1977, r. 1978. Director: Michael Hall. Distributor: Image Resources.

Examines the current state of agriculture in southern New Hampshire by documenting six different, small family farms which are threatened by population growth, increased taxes, and low earnings. Focuses on the need for planning and the lack of government awareness and concern on the issues.

The House of Man Part II: Our Crowded Environment, 11 min., color, 1968. Producer: The Conservation Foundation. Distributor: Encyclopaedia Britannica Educational Corp.

Explores the problems of overcrowded cities, housing and food shortages, industrial pollution, exploitation of natural resources—created largely by increases in the birthrate. At the same time the death rate has decreased. Well-structured film which suggests that our technological understanding is still faulty, and that we must use technology to settle some of the problems it created. —J.R.

Research to Prevent Cancer, 15 min., color, 1976. Director: Larry Yust. Distributor: Association Films.

A direct, simple presentation of cancer research; top scientists and physicians discuss their findings. Explores the possible causes of cancer, attempts to identify carcinogens, evaluates statistics. Contains a laboratory sequence involving newborn monkeys. Good photography. With Gregory Peck and Danny Thomas. —J.R.

Sorry, No Vacancy, 27 min., color, 1973. Director: James Wilhite. Distributor: Malibu Films.

Illustrates the conflict of uncontrolled population growth and man's consumption of resources. Intelligently presented information, although some of the montages diminish the overall impact of the film. Contains interviews with Dr. Paul Ehrlich, Dr. William Paddock, U Thant, and others. Rod Serling narrates. Good to use for discussion of man's responsibility to man and possible solutions to the problems of irresponsible consumption. —J.R.

Soylent Green, 97 min., color, 1973. Director: Richard Fleischer. Distributor: Films Inc.

Interesting ideas on overpopulation, food shortage, and mercy killing are found in an otherwise pedestrian police thriller set in polluted, overcrowded, crime-ridden New York City of the future. The surprise ending reveals that bodies from the state-sponsored euthanasia centers are recycled into Soylent Green crackers, one of the food staples rationed to the masses. A more plausible and frightening depiction of the effects of ecological crises is **No Blade of Grass** (97 min., color, 1970. Director: Cornel Wilde. Distributor: Films Inc.), in which an army of refugees from diseased, riot-torn London of the near future strike out for sanctuary in the countryside only to battle various like-minded groups. —B.C.

Voices of Hunger, 35 min., color, 1975. Producer: Gateway Productions. Distributor: Time Life Multimedia.

This compelling documentary, hosted by Bill Moyers, surveys the food situation in India where half the population is always hungry. Famine, floods, population growth, black market, and need for land reform and modern techniques are shown as the plight of these people. This prizewinning film is edited from the original 90-minute version which is also available: **World Hunger: Who Will Survive?** (Time Life Multimedia). —E.M.

Which Energy, 23 min., color, 1976. Director: Marty Malin. Distributor: Stuart Finley.

Compares our different present and future energy sources by visiting field installations and research laboratories, showing fossil fuels, nuclear fusion and fission, including the breeder reactor, solar energy and wind, and conservation concepts.

World Population, 3 min., color, 1972. Producer: Zero Population Growth, Inc. Distributor: Perspective Films.

Traces the growth and spread of population from 1 A.D. to 2000. On a globe, small dots appear, slowly at first, but increasing at a geometric rate. Softly, a heartbeat begins; the sound quickens and intensifies (with the dots)—like a time bomb, waiting to explode. Animated. Presents the problem of overpopulation in a terrifyingly simple way. A good discussion starter. —J.R.

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8 Incentives for Innovation: Technology and the Economy

Controlling Interest: The World of the Multinational Corporation, 45 min., color, 1978. Producer/Distributor: California Newsreel.

A documentary that explores the insidious growth and influence of multinational corporations which rape the natural resources of Third World countries, leave the population in poverty and ignorance, and contrive to be accountable to no country by nature of their multinational organization. Examines the quandary of a New England union that shadowboxes with the corporation that owns their factory and dictates unreasonable demands (cuts in pay, a stipulation that the town build and pay for a new factory building or the corporation would close down the factory). An exposé of super capitalists who maintain their anonymity while maximizing their profits. —M.C.

The Farmer in a Changing America, 27 min., color, 1973. Directors: Randolph Hobler & Paul Stein. Distributor: Encyclopaedia Britannica Educational Corp.

Since the Depression, agribusiness has replaced agriculture. An individual farm can stretch for miles and is so completely mechanized that farm work is comparable to factory work. Farmers have become managers, and scientific advances have so improved standardization and quantity that 2 percent of the population feeds the other 98 percent. Concentrates on the vast machinery that has revolutionized the harvesting and processing of crops, and the wave of the future when farming will be carried out in domed, controlled environments. —M.C.

Food: Green Grow the Profits, 56 min., color, 1974. Director: James Benjamin for ABC-TV News. Distributor: Macmillan Films.

The premise of this documentary is that control of the growing, processing, and marketing of many foods in the U.S. has become an agribusiness dominated by the demand for increasing corporate profits. Shows that this profit motive is pushing technological and marketing efficiency at the expense of the taste and nutritional value of our food; that the work being done to make today's food products more profitable is being financed by the taxpayer's money and, in return, the consumer is getting a product that is harmful to the body, brain, and nervous system. The U.S. Government's Food and Drug Administration is accused of winking at infractions of its laws, and the agribusiness conglomerates are accused of keeping their suppliers—the small farmers and growers—in feudal fiefdom. —J.M.

Innovation, 26 min., color, 1976. Producer: Playback Associates, for Phillips Petroleum. Distributor: Modern Talking Picture Service.

Narrated by William Shatner, this film takes a look at American innovators: men and women like Edison who put theories to work on utilitarian products. Throughout the history of the U.S. technology was used to increase productivity: Whitney developed machines to make muskets, Oliver Evans' grain processing mill foreshadowed the assembly lines by 100 years, Ford gave the average man an affordable auto when he automated his plants. Traces our successes from the early applications of "Yankee ingenuity" in the 18th century to modern-day research and development (R&D) teams in large corporations. From the *American Enterprise* series. —C.A.E.

The Man in the White Suit, 85 min., b&w, 1951. Director: Alexander Mackendrick. Producer: Ealing Studios. Distributor: Janus Films.

The British have always been particularly adept at championing the underdog against the establishment. Here, chemist Sidney Stratton (Alec Guinness) takes on both capital and labor by inventing a miracle fiber that will never get dirty or wear out. The economic repercussions for the textile industry are immediately perceived by both the mill owners and workers who join forces to suppress the discovery. Their exertions are needless, for Sidney's formula has a flaw in it. Another polite slap at progress is delivered in **The Titfield Thunderbolt** (84 min., color, 1953. Director: Charles Crichton. Producer: Ealing Studios. Distributor: Janus Films), in which the townspeople pull together to keep the local train from being replaced by a bus line. They argue that the buses are more dangerous and will ruin their quiet clean town. How right they were. —M.C.

The Medieval Gilds, 21 min., color, 1966. Producer/Distributor: Encyclopaedia Britannica Educational Corp.

Describes the economic organization of the gilds by concentrating on the shoemakers' gild. Gilds are likened to Chambers of Commerce or trade organizations which oversee the output of a particular craft by regulating prices, raw materials, production levels, and quality. The masters of the gilds began as simple craftsmen who were transformed by expanding trade into capitalists and abandoned the performance of their craft for entrepreneurial functions. A good, but not very sophisticated historical re-creation. —M.C.

Money on the Land, 52 min., color, 1972. Producer: Michael Gill for BBC-TV. Writer/Narrator: Alistair Cooke. Distributor: Time Life Multimedia.

Alistair Cooke's droll commentary on the rise of capitalism in the U.S. covers the change from a nation of yeoman farmers to one of urban dwellers and factory workers. He examines the sweeping changes in agriculture that were achieved during the 19th century through inventions like the reaper and combine, which paradoxically made the farmers' lot tougher: the increased productivity caused prices to drop so much that farmers went into debt to pay for the technology that increased their output. Cooke also examines the rise, achievements, and guiding mentalities of the giant capitalists Rockefeller and Carnegie and the inventor-entrepreneur Thomas A. Edison. From the *America* series. Might be used in tandem with two accounts of fictional capitalists: In **A Corner in Wheat** (12 min., b&w, 1909. Director: D. W.. Griffith. Distributor: Museum of Modern Art), wheat king Frank Powell's coups on the market are contrasted with the distress his machinations cause. **Come and Get It** (99 min., b&w, 1936. Directors: Howard Hawks & William Wyler. Distributor: Audio Brandon Films) focuses on the lumber industry and how the exploitation of America's forests made one man wealthy. —M.C.

The Prophets and Promise of Classical Capitalism, 60 min., color, 1977. Producer: Adrian Malone for BBC-TV. Writer/Narrator: John Kenneth Galbraith. Distributor: Films Inc.

Galbraith looks at the lives and theories of the founders of economics: Adam Smith, laissez-faire and the division of labor theory; David Ricardo and the labor theory of value; Malthus and his population theory; as well as such lesser lights as the physiocrats and early communist utopias such as that of Robert Owen at New Harmony, Indiana. From the *Age of Uncertainty* series. Might be used with another series entry, **Karl Marx—The Massive Dissent** (60 min., color, 1977. Producer: Adrian Malone for BBC-TV. Writer/Narrator: John Kenneth Galbraith. Distributor: Films Inc.), which highlights the career and writings of the socialist theorist. —M.C.

The Renewable Tree, 59 min., color, 1975. Director: Ben Shed. Distributor: Time Life Multimedia.

A documentary on the forest industry and its claim that trees are a renewable resource. Shows the history of tree farming, the application of genetic research in tree production, and modern management techniques as applied to the cutting of trees. The basic tenet is to question whether trees grown for the lumber industry are, in fact, a renewable resource. The film may be used to instigate discussion on whether technology is in itself beneficial and/or whether the application of technology is what causes problems. —C.S.

Some Call It Greed, 51 min., color, 1978. Director: Timothy Forbes. Distributor: Forbes Magazine.

A celebration of the 60th anniversary of *Forbes* magazine, based on an essay entitled "What Makes America So Great," by Malcolm Forbes, Jr. The thesis of this film is that the United States became a powerful nation because of incentive: the incentive of the robber barons who were the "creators of great enterprises." Thus, the film praises the ingenuity and resourcefulness of such men as J. P. Morgan, J. D. Rockefeller, Henry Ford, and Ray Kroc (the "inventor" of MacDonalds). Great stress is placed on the ramifications of their "great enterprises," especially the invention of the automobile and the related use of the assembly line, which are cited as the catalysts of change. Ford's production methods, for example, are said to have inspired Frederick Maytag, who automated the washboard. The proliferation of cars led to the expansion of road building programs and changed the American lifestyle: people no longer bought from catalogs, but drove directly to chain stores. The film covers 60 years of American history, emphasizing our change from an agrarian to a consumer society and the related inventions that fed that consumerism. —K.S.

9 Science and Technology

Benjamin Franklin: Scientist, Statesman, Scholar and Sage, 30 min., color, 1969. Producer: Leo A. Handel. Distributor: Handel Film Corp.

Serves as an introduction to the multi-faceted life of Franklin. He was a signer of the Declaration of Independence, an ambassador, a printer, author of *Poor Richard's Almanac*, and an inventor. He developed the lightning rod, bifocal glasses, the Franklin stove, the four-sided street lamp, and scores of utilitarian products, but he never earned money from them; he donated them for the public good. Uses authentic sites memorabilia, and stills for the visuals. —C.A.E.

Ego Trap, 5 min., color, 1977. Director: Jozsef Nepp. Distributor: Bosustow Productions.

A whimsical animated film in which an aircraft designer creates a blueprint for a fine new plane to replace his company's old biplane. His boss makes a few changes, and a few more, until the plane looks like him. Of course, it can't fly, so the company resumes manufacturing the biplane. —C.A.E.

Einstein, 42 min., b&w, 1969. Producer: BBC-TV. Distributor: Time Life Multimedia.

An absorbing portrait of the scientific genius Albert Einstein, told by his friends and colleagues. His aide Banesh Hoffman simply and thoroughly explains the theory of relativity. For more on Einstein, see **Albert Einstein: The Education of a Genius** (44 min., color, 1974. Director: Harold Mantell. Narrator: Peter Ustinov. Distributor: Films for the Humanities). This film's emphasis is upon Einstein's early years as a nonconformist child, his education in Swiss schools, his first job as a patent examiner, and the route to his discoveries. —C.A.E.

For You, Mr. Bell, 16 min., color, 1973. Director: William Canning for the National Film Board of Canada. Distributor: Learning Corp. of America.

This warm portrait of the inventor of the telephone, Alexander Graham Bell, emphasizes his work with the deaf and his founding of the National Geographic Society. —C.A.E.

Hidden Structure, 52 min., color, 1974. Producers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Illustrates the ways in which differing perceptions of a scientific and technological problem more or less facilitate an effective solution. Defines the essence of invention as, "... ask an impertinent question and you are on the way to a pertinent answer." Includes the work of such inventors as: Paracelsus, Priestley, John Dalton, Lavoisier, and Boyle, as well as such chemical/technological discoveries as bronze by Chinese craftsmen and Japanese samurai swordsmiths. Useful to provide a stimulating overview of the general, somewhat complex history of invention in the world. From *The Ascent of Man* series. —S.J.

The Wizard Who Spat on the Floor, 41 min., color, 1974. Producer: Robert Vas for BBC-TV. Distributor: Time Life Multimedia.

Presents Thomas Alva Edison, the man and the inventor, through documentary footage and rare interviews, including one with his daughter. Edison held over 1,300 patents and developed the electric light bulb, the stock ticker, the multiplex telegraph, and the phonograph. His inventions often built on the work of others and he said, "Everyone steals in commerce; I've stolen a lot myself, but I know how to steal." —C.A.E.

10 The Imperatives of Engineering

Blue Collar, 114 min., color, 1978. Director: Paul Schrader. Distributor: Universal/16.

The economic, social, racial, and political pressures on three buddies on the Detroit assembly line. Honest, hard-hitting drama of labor conditions today. **Car Wash** (97 min., color, 1976. Director: Michael Schultz. Distributor: Universal/16) offers a more comedic, but no less truthful, look at how American workers cope on the job. —B.C.

Humain Trop Humain (Human Too Human), 77 min., color, 1972. Director: Louis Malle. Distributor: New Yorker Films.

A non-narrated detailed observation of the assembly lines in a Citroën automobile plant in France. Forming an interlude in the assembly line scenes is a sequence shot at an auto show where buyers and browsers talk about the pros and cons of the year's new cars, including the quality of workmanship. Gives an excellent sense of the factory environment and the repetitive nature of assembly line work. —N.C.

Nuclear Countdown, 28 min., color, 1978. Producer: United Nations. Distributor: Journal Films.

The rapid momentum of technology sometimes leads to inventions with far-reaching consequences for mankind, such as the nuclear bomb. The promise of a peaceful atom is still largely unfulfilled, while the arms race continues. One out of four scientists is employed in defense work today. This film clearly calls for nuclear disarmament. —C.A.E.

One, Two, Three . . . Clean, 12½ min., color, 1977. Producer/Distributor: Stuart Finley.

Describes a three-step modern sewage treatment process. Explores the way technology has successfully managed to clean the billions of gallons of sewage created daily, and return it to a river or stream without polluting. Excellent photography of the processes involved; narration clearly explains the various steps. Filmed at the Piscataway (New Jersey) tertiary treatment plant. —J.R.

Sapporo: Planned Growth, 57 min., color, 1974. Producer/Distributor: National Film Board of Canada.

With a population of over a million, Sapporo, Japan, is a model of a well-designed city with many anti-pollution and energy efficient measures built into its growth plan. The measures include encouraging public transportation (bus, metro), monitoring traffic flow, creating a green belt around the city, developing river banks, lakes, and ponds into public parks, and decentralizing the city center to avoid congestion. From the *Urba 2000* series which is devoted to urban planning. Contrasts with the rather different British approach in **Basingstoke – Runcorn – British New Towns** (87 min., color, 1974. Director: Michel Regnier. Distributor: National Film Board of Canada). Britain has developed 30 new towns as a means of relieving the pressure on large urban centers. Basingstoke, which is 40 miles southwest of London, combines residential with industrial advantages. Runcorn is a suburb of Liverpool, but there is some question whether Runcorn relieves population pressure on the larger city or merely allows the rundown areas to deteriorate further by draining away industry and the middle-class population. The series format leans toward talking heads, but the questions and concerns raised are those of all urban centers that are planning their future in the face of high industrialization and increasing population. —M.C.

The Taking of Pelham 1-2-3, 104 min., color, 1974. Director: Joseph Sargent. Distributor: United Artists/16.

The inner workings of the New York City subway system are seen as never before in this action tale of the hijacking of a subway car. The technology of the subway system is employed by both the transit police and the bandits (one of whom is a subway motorman) in a game of wits. —B.C.

The 3rd Pollution, 23 min., color, 1966. Director/Distributor: Stuart Finley.

Increases in population mean increases in solid waste; each person, each day, contributes almost five pounds of waste material to the already over-burdened environment. Film explores a variety of alternative methods for handling this waste so that it can contribute to, rather than detract from, our planet. Well-structured and photographed, but the music is overbearing. Doesn't promote one single answer, so the different procedures outlined in the film should provide a basis for lively and informed discussion. —J.R.

11 Wars: Hot and Cold

Air Force, 124 min., b&w, 1943. Director: Howard Hawks. Distributor: United Artists/16.

With the advent of World War II and the extensive propaganda efforts required of Hollywood, military technology began to play an important part in war movies. **Air Force** is a prime example of the type of war film in which the instruments of battle took center stage. In this case, a bomber crew struggles against all odds to keep its B-17 flying and fighting through three battlefields in the Pacific immediately following the outbreak of hostilities. A submarine was the focus of **Destination Tokyo** (135 min., b&w, 1943. Director: Delmer Daves. Distributor: United Artists/16); a tank in **Sahara** (97 min., b&w, 1943. Director: Zoltan Korda. Distributor: Audio Brandon); a Liberty Ship in **Action in the North Atlantic** (127 min., b&w, 1943. Director: Lloyd Bacon. Distributor: United Artists/16) and PT boats in **They Were Expendable** (135 min., b&w, 1945. Director: John Ford. Distributor: Films Inc.). —B.C.

Armaments: The War Game, 18 min., color, 1972. Director: Patrick Corbett. Distributor: Document Associates.

Spectacular stock footage is used to present recent developments in military strategy and technology, including computer control of weaponry; harnessing the elements to wage environmental warfare; military capability in outer space and under the sea; laser beams; one-man anti-gravity machines. Dr. Donald G. Brennan of the Hudson Institute thinktank and Dr. Jerome B. Weisner of M.I.T. offer the pros and cons of weapons development. Concludes by expressing optimism in the peace movement of the time, but the movement has since died, thus dating the film. The weapons segments are still effective. —B.C.

The Arsenal, 52 min., color, 1972. Director: David Heycock. Distributor: Time Life Multimedia.

Alistair Cooke takes us on a guided tour of the past and future of American weapons technology from "the rifle by the fireplace to the shatterer of worlds." After presenting a selective version of changes in U.S. defense policies from the Revolution to Vietnam, Cooke focuses on issues raised by "the technology of unthinkable war" by showing us assorted U.S. nuclear weapon command posts and pointing out their capabilities. A diversity of stock footage (including rarely seen anti–World War II protests), crisp editing, and Cooke's insightful narration make this a superior social studies film for age groups from junior high on up. From the series *America: A Personal History of the United States.* —B.C.

Hiroshima-Nagasaki—August 1945, 16 min., b&w, 1971. Producer: Erik Barnouw. Distributor: Indiana University, Audio-Visual Center (rental only).

The destruction of Hiroshima and Nagasaki in August 1945 by U.S. atomic bombs was recorded by Japanese cameramen, but this footage was withheld from the public by U.S. authorities for more than 20 years. For the first time, this film—made from that original footage—gives Americans the painful opportunity to see the human toll of the decision to drop the bomb. —N.C.

Impact of War, 26 min., color, 1971. Producers: John Christophel & Robert L. Garthwaite. Distributor: Pictura Films.

Reconstructs, through skillful use of stock footage, U.S. involvement in global war from the Spanish-American War to Vietnam, with special emphasis on our entries into World Wars I and II and the advances in military technology employed therein. The segments on Korea and Vietnam are brief and designed to point out how little we've absorbed from the lessons of the World Wars. Over footage of Vietnamese funeral processions, host-narrator Charles Blair declares that "the ultimate anti-war protest is the shedding of tears." A rare curriculum film that moves as well as instructs. —B.C.

The Plutonium Connection, 59 min., color, 1975. Producer: WGBH-TV. Distributor: Time Life Multimedia.

Episode of *Nova* which points out the ready availability of key information on nuclear technology and the possibility of plutonium theft because of weak security and accounting measures employed by atomic energy plants. Pointedly declares that a resourceful terrorist group would be willing and able to fashion crude, but effective, nuclear weaponry. A lesser power, such as Israel or India, supplied with "peaceful" nuclear technology, could easily convert it to make nuclear weapons. Informative, though rambling, it consists of interviews, location footage, and Robert Redford's narration, which makes a convincing case for tighter safeguards on the development of nuclear power. —B.C.

The Satan Bug, 114 min., color, 1965. Director: John Sturges. Distributor: United Artists/16.

A lethal virus is stolen from a top-secret biological research installation and authorities race against time to prevent its release. Simple, competent suspense thriller pointing out the dangers of a chemical and biological warfare program. With the notable excep-

tions of **The Andromeda Strain** (137 min., color, 1971. Director: Robert Wise. Distributor: Universal/16) and **The Omega Man** (98 min., color, 1971. Director: Boris Sagal. Distributor: Audio Brandon), germ warfare never really caught on with moviemakers and audiences the way nuclear holocausts did. A dated television documentary on the subject is **CBW: The Secrets of Secrecy** (47 min., color, 1969. Director: Tom Pettit. Distributor: Films Inc.). —B.C.

A Thousand Cranes: The Children of Hiroshima, 24 min., b&w, 1968. Director: Betty Jean Lifton. Distributor: Macmillan Films.

Long after the A-bomb destruction of Hiroshima, the survivors and the offspring of the victims still confront the crippling aftereffects of radiation exposure. Yet neither bitterness nor vengefulness inform their actions, only a sincere desire for a lasting peace. A beautiful and haunting film that is both a tribute to the Japanese spirit and an effective anti-war statement. —B.C.

Twilight's Last Gleaming, 144 min., color, 1977. Director: Robert Aldrich. Distributor: Hurlock Cine-World.

Incisive features on the abuses of nuclear weaponry have been few and far between. **The Bedford incident** (102 min., b&w, 1965. Director: James B. Harris. Distributor: Audio Brandon) involves a cold war cat-and-mouse game between a nuclear-equipped American destroyer and a Soviet sub in the North Atlantic. In **Ice Station Zebra** (148 min., color, 1968. Director: John Sturges. Distributor: Films Inc.), a U.S. nuclear sub races Soviet aircraft to the North Pole for recovery of a Russian reconnaissance satellite. More recently, **Twilight's Last Gleaming** focuses on a bizarre incident of nuclear blackmail, in which a renegade Air Force general and two fellow escapees from a military prison seize control of an underground missile command post and threaten to launch nine Titans if their demands to the president aren't met. One of their demands: broadcast the contents of a top-secret document regarding U.S. involvement in Vietnam. Unbearable suspense ensues when the general opens the silo hatches and begins the launch countdown after armed attackers trip an alarm. Violent conclusion demonstrates the incongruity of individual heroics in the face of such awesome war machinery. —B.C.

The War Game, 49 min., b&w, 1966. Director: Peter Watkins for BBC-TV. Distributor: Films Inc.

Newsreel-style documentary of nuclear attack on England depicts the effects on one community and is enacted by its residents (all non-professionals). Shows the hurried evacuation proceedings and weak preparation measures before the blast; and the death, disease, destruction, and disorder afterwards. No other film has so graphically presented the horrifying effects of a nuclear attack on its innocent victims nor has any other film made such a convincing case against the proliferation of nuclear power. Because the information on which the film is based dates back to Hiroshima, Dresden, and other World War II bombing sites, the implication is that an actual attack by today's many-times-more-powerful bombs would be far more devastating than the attack described in the film. Points out the appalling lack of information available to the public on the effects of nuclear war. Highly recommended viewing for everyone. —B.C.

12 The Government's Role in Technological Change

Defense and Domestic Needs: Contest for Tomorrow, 77 min., color, 1969. Producer: Public Broadcast Laboratory of National Educational Television. Distributor: Indiana University, Audio-Visual Center.

Interviews with congressmen and assorted public officials offering differing views on defense needs are intercut with lively footage of weapons demonstrations to point out the enormous influence of the military, defense contractors, and their civilian lobbyists on the formulation of defense policies and their staggering costs to the U.S. taxpayer. Although this television documentary was made at the height of the Vietnam War ten years ago, its depiction of the interaction between government, the military, industry and the public, and the resultant effect on defense strategies and costs is still accurate. The message that only a concerted effort by taxpayers will reverse the trend toward increased and wasteful spending is also still relevant. —B.C.

Dr. No, 105 min., color, 1963. Director: Terence Young. Distributor: United Artists/16.

Technology at its most fanciful serves both hero and villain of the fantastically popular series of movies featuring James Bond, agent 007 of the British Secret Service. Dr. No uses nuclear power to divert the course of rockets fired from Cape Canaveral before the operation is sabotaged by the quick wits and fists of Bond. In **From Russia with Love** (118 min., color, 1963. Director: Terence Young. Distributor: United Artists/16), Bond uses a weapons-laden attaché case to battle his enemy counterpart over control of a sophisticated Soviet decoding machine. **Goldfinger** (108 min., color, 1964. Director: Guy Hamilton. Distributor: United Artists/16) plans to corner the world's gold market for himself by blowing up Fort Knox with an atomic bomb. One of the flashier tools at Bond's disposal here is a gadget-ridden Aston Martin complete with an ejector seat and machine guns behind the headlights. In **Thunderball** (132 min., color, 1965. Director: Terence Young. Distributor: United Artists/16), SPECTRE, the international syndicate of evil, holds two hijacked atomic bombs for ransom before Bond, equipped with an underwater rocket pack, leads the CIA to the rescue. A mammoth SPECTRE spacecraft swallows orbiting U.S. and Russian space capsules in order to provoke a world war in **You Only Live Twice** (116 min., color, 1967. Director: Lewis Gilbert. Distributor: United Artists/16). Among the weapons Bond employs here are samurai swords and a lightweight, portable, missile-equipped, one-man helicopter. **Twice** offered the most elaborate technology of the series, only to be surpassed ten years later (after four more Bond films) by **The Spy Who Loved Me** (125 min., color, 1977. Director: Lewis Gilbert. Distributor: United Artists/16), the most recent Bond film, which featured the hijacking of two nuclear submarines. **Moonraker,** the next entry, promises to send Bond into outer space. The Bond films popularized technological advances as no other movies have. The science and defense industries could not ask for better public relations. —B.C.

Dr. Strangelove, or How I Learned to Stop Worrying and Love the Bomb, 93 min., b&w, 1964. Director: Stanley Kubrick. Distributor: Swank.

An accidental nuclear attack on Russia caused by a fanatical right-wing Air Force general results in the triggering of the world-destroying Doomsday Machine. Kubrick's satirical treatment and exaggerated comic characterizations make us painfully aware of the immaturity and irresponsibility displayed by the world powers (particularly the U.S.) in their attempts to dominate the unwieldy power of the atom. —B.C.

Dossier 51, 108 min., color, 1978. Director: Michel Deville. Distributor: New Yorker Films.

A complete personality profile of a newly appointed French government official (code-named "51") is compiled by a top-secret agency which shares its point of view with the audience through wiretaps, secret cameras, and clever operatives, who infiltrate every aspect of 51's past and present life. Alarming in its depiction of the true extent of government surveillance and invasion of privacy. Critical opinion of this film was sharply divided because of many reviewers' inability to comprehend the current technological advances in spying and the ongoing abuses of these advances by government agencies. In a more personal vein, **The Conversation** (113 min., color, 1974. Director: Francis Ford Coppola. Distributor: Paramount) probes the effect of his work on a professional wiretapper. —B.C.

Lovejoy's Nuclear War, 60 min., color, 1975. Director: Dan Keller. Distributor: Green Mountain Post Films.

An anti-nuke film centered on an act of civil disobedience: Sam Lovejoy levels a 500-foot utility tower belonging to a nuclear power plant in order to dramatically focus the attention of the community and the media on the hazards of nuclear power as an energy source. Presents both sides of an issue that assumes great importance in this day of oil shortages, energy conservation, and environmental protection.

Max Havelaar, 165 min., color, 1979. Director: Fons Rademakers. Distributor: New Line Cinema.

Describes how Dutch colonists brought the East Indies to heel by reducing the natives to a slave force, manipulating the royal family, and exploiting the wealth of the land; and how one Dutch official, Max Havelaar, tried to lessen the misery his government and the traders' greed was causing. Based on a novel by Multatuli, which was published just before the American Civil War, it offers parallels with the treatment of American blacks. —M.C.

The Metric Movie, 15 min., color, 1975. Director: Les Novros. Distributor: Best Films.

Opens with a brief animated history of measurement, then introduces, compares, illustrates, and clarifies the fundamental concepts of the SI metric system: base units, derived units, multiple and sub-multiple prefixes. A useful introduction to the subject.

Patent Pending, 55 min., color, 1976. Producer: Post-Newsweek. Distributor: Lucerne Films.

Traces the history of the U.S. Patent Office, and presents both whimsical inventions and those that changed American life: the cotton gin, the McCormick harvester, the automobile, barbed wire, linotype, and the telephone, which is the most profitable patented device in the U.S. The second part of the film focuses primarily on the recent developments within the communications industry and computer technology. Narrated by William Shatner. —C.A.E.

Paul Jacobs and the Nuclear Gang, 58 min., color, 1979. Directors: Jack Willis & Saul Landau. Distributor: The Center for Documentary Media.

In 1957, journalist Paul Jacobs began investigating the story of a possible cover-up by the government of information about the effects of low-level radiation on those exposed to fallout from atomic tests and to workers in atomic energy plants. He pursued this story for the next 20 years until his death in January 1978 from lung cancer, which he may have contracted as a result of exposure to low-level radiation in the course of his investigations. Two of his colleagues, Willis and Landau, filmed Jacobs during his last months and pursued the story of the cover-up after his death. Their investigations, verified by revelations of government-sponsored studies, indicated that the incidence of various types of cancer was much higher in areas where nuclear testing had taken place in the 1950s and also among workers in nuclear plants. A powerful, well-documented report on the potential dangers of rapid technological development without adequate safeguards for human beings. —N.C.

The Rise and Fall of Money, 57 min., color, 1977. Producer: Adrian Malone for BBC-TV. Writer/Narrator: John Kenneth Galbraith. Distributor: Films Inc.

John Kenneth Galbraith narrates this story of money through the ages—how money affected and was affected by history. He stresses that money has always presented problems because it was either abundant and unreliable, or reliable and scarce, or, worse, unreliable and scarce. These problems led to regulation. In 17th-century Amsterdam, the moneychangers formed a bank which returned to weighing coins and brought coinage under public control. In 1694, the Bank of England was formed and provided all the functions of a central bank. The American Revolution introduced another form of money—paper currency so corrupt in value that the resulting inflation gave birth to the epithet of opprobrium "not worth a continental." For more than a hundred years, efforts to establish a U.S. national bank were unsuccessful until the passing of the Federal Reserve Act of 1914 created a central bank that could cushion the impact of hard times. The Depression ushered in the Keynesian Revolution and brought increased government control of money and prices. An informative guide to the changing concept of money and an entertaining film despite the gimmickry of carnival sets and fussy visuals. From the *Age of Uncertainty* series. —M.C.

The River, 30 min., b&w, 1937. Director: Pare Lorentz. Photographers: Stacey Woodard, Floyd Crosby, Willard Van Dyke. Music: Virgil Thomson. Distributor: Images.

Classic Thirties' documentary that follows the Mississippi (and its tributaries) from its source to the sea; and studies the industry, life, and trade that depend on the river and the hardships caused by the river. A beautiful buildup to some propaganda for the Tennessee Valley Authority, the government-financed corporation that harnessed the energy of the Tennessee River and converted it into electrical power. —M.C.

Ten Who Dared Series (10 films), 49 min. each, color, 1976. Producers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Each film focuses on a different explorer. Titles include: **Christopher Columbus: The Americas, 1492; Francisco Pizarro: Inca Nation, Peru, 1532; Captain James Cook: South Pacific, 1768; Alexander von Humboldt: Venezuela, 1799; Jedediah Smith: America, 1826; Burke and Wills: Australia, 1860; Henry Morton Stanley: Congo River, 1874; Charles Doughty: Arabia, 1877; Mary Kingsley: West Africa, 1893; Roald Amundsen: South Pole, 1911.**

13 The Mystery of Inventiveness

Here Is Tomorrow, 28 min., color, 1967. Director: Jack Denove. Distributor: New York Telephone Film Library.

A dramatization of Alexander Graham Bell's career, beginning with a re-enactment of the first public airplane flight. Although credit is given to the Wright Brothers for their innovation, further innovations in the flying machine were developed by Bell: hinged wing tip, covered cockpit, and the steerable three-wheeled undercarriage. Moreover, Bell's improvements of the airplane were worked out while he flew a kite—another ramification of Ben Franklin's favorite hobby. Less familiar Bell inventions are also covered: the vacuum jacket, which was the forerunner of the iron lung machine, and improvements on Edison's phonograph. These inventions are good examples not only of the ramifications of invention, but of the scientific mind at work, as Bell was able to perfect already existing ideas. The invention of the telephone is, perhaps, the best example of an accidental discovery. However, what is usually forgotten is that Bell originally set out to develop the harmonic telegraph to transmit several telegrams simultaneously. While working on this device, he "chanced" to hear a twang through the receiver, and the notion of a telephone was born. A promotional film for Bell Telephone which glorifies Mr. Bell.

For another approach see **The Story of Alexander Graham Bell** (97 min., b&w, 1939. Director: Irving Cummings. Distributor: Films Inc.). —K.S.

The Indomitable Blacksmith: Thomas Davenport, 20 min., b&w, 1953. Director: William J. Thiele. Distributor: Indiana University, Audio-Visual Center.

Dramatization of blacksmith Tom Davenport's discovery in the 1830s of the principle behind the electric motor, and his efforts to develop a practical, working model. The moment of discovery is shown as accidental: a spinning wheel that Davenport repaired with an iron patch moves when it comes in contact with an electromagnet. Observes that industrialists of the period, committed to steam power, remained unconvinced of the potential of Davenport's invention. From *The Cavalcade of America* series. —K.S.

Koestler on Creativity, 40 min., color, 1971. Producer: BBC-TV. Distributor: Time Life Multimedia.

Visually imaginative semi-documentary based on discussions by Arthur Koestler, author of *The Act of Creation.* Useful to compare and contrast the scientific and technological discovery process with artistic creativity as it is often understood by lay persons. Clarity and compelling arguments and examples illustrate the complexities of the "inventive leaps" made by creators in all walks of life. —S.J.

Louis Pasteur—Man of Science, 27 min., b&w, 1952. Producer: Viking Films. Distributor: Sterling Educational Films.

Louis Pasteur's experimental work included determining where microbes and germs come from, how infectious diseases spread, and how to combat diseases such as anthrax and rabies. This is a dramatization of how Pasteur set about finding the answers to these questions. Although an old-fashioned film, it gives a good idea of his system of logic and his use of the scientific method. It also includes one moment of Pasteur acting on an "inspired guess." Pasteur found an old batch of chicken cholera bacilli in his lab. He injected some chickens with it, and, after a brief illness, they recovered. He then injected them with fresh microbes of the disease—it had no effect. He reasoned that they had become immunized by the older microbes, and so he went on to create vaccines for anthrax and, later, rabies. It is clear that his "inspired guess" had ramifications of great importance. —K.S.

Young Tom Edison, 86 min., b&w, 1940. Director: Norman Taurog. Distributor: Films Inc.

Mickey Rooney portrays Thomas Edison as a young man in this biography that covers the young inventor's Port Huron years, during which time most of the townfolk, his father among them, thought there was something strange about young Edison. He spend his pocket money on chemicals, almost blew up the schoolhouse with an experiment, nearly wrecked a train with a bottle of home-made nitroglycerine, among other apocryphal things. This is the first chapter of a two-part biography; part two is **Edison the Man** (107 min., b&w, 1940. Director: Clarence Brown. Distributor: Films Inc.) in which Spencer Tracy portrays Edison. The story begins with Edison, aged 82, on the night of the celebration of the 50th anniversary of the electric lamp, then flashes back to the years when he was an unknown inventor. Includes his fortuitous invention of the phonograph; and his ordeal with the incandescent lamp. —K.S.

14 Technology and the Seamless Web: Ethical Dilemmas

Are You Doing This for Me, Doctor, or Am I Doing This for You, 52 min., color, 1975. Producer: Peter Jones. Distributor: Time Life Multimedia.

Explores the ethics of live human patient experimental medicine. Opens with a series of exposé episodes on ethically questionable research projects completed in the United States and Great Britain. The film points out that codes for medical research on human patients were not developed until after World War II, and questions whether the codes are being adhered to today. This film would be excellent for initiating discussion about whether we can ethically implement new technology into medicine without considering more public involvement in the experimentation process. —C.S.

Bruce and His Things, 16 min., color, 1977. Director: Mike Haller. Distributor: Helios Flying Studio.

A successful, young professional's obsession with his material possessions is contrasted with scenes from his personal history (in photos and home movies), and modern American cultural history. —N.C.

... But What If the Dream Comes True, 52 min., color, 1971. Producer: CBS-TV. Distributor: Carousel Films.

A leisurely, introspective, disturbing documentary about the ethics, moral values, and place of men, women, and children among upper income, nouveau riche WASPs in the American Midwest. An exposé of the current malaise of having everything and being completely unfulfilled. —J.M.

The Cave, 10 min., color, 1974. Director: Sam Weiss. Distributor: Bosustow Productions.

Orson Welles narrates this animated rendering of Plato's parable of how we are all forced to understand new knowledge—easily analogous to the idealized process inherent in the so-called scientific method of orderly invention, including the element of chance. Useful to initiate discussion of the nature of human responsibility for understanding natural laws, especially as they interact with new technologies. —S.J.

A Clockwork Orange, 137 min., color, 1971. Director: Stanley Kubrick. Distributor: Swank.

The decadence of the near future is met with crude attempts at behavior modification in this provocative film about a young, violent, amoral, bourgeois gang leader, conditioned by the authorities to reject sex and violence. —B.C.

Colossus—The Forbin Project, 100 min., color, 1970. Director: Joseph Sargent. Distributor: Universal/16.

Colossus, a self-contained computer system programmed to defend the Western world, asserts its control over all U.S. nuclear stockpiles and, after establishing communication with its Soviet counterpart, begins giving orders. An engrossing, harrowing dramatization showing where our dependence on computers could lead us. A more fanciful and philosophical version of the same theme is the French **Alphaville** (100 min., b&w, 1965. Director: Jean-Luc Godard. Distributor: Corinth), in which private eye Lemmy Caution uses love, violence, and poetry to subvert the control of master computer Alpha 60. **Westworld** (88 min., color, 1973. Director: Michael Crichton. Distributor: Films Inc.) and its superior sequel, **Futureworld** (104 min., color, 1976. Director: Richard T. Heffron. Distributor: Swank) present a computer-operated Disneyland with lifelike robots on hand to satisfy human visitors' *every* need. In the former, the Westworld robots get their wires crossed and begin shooting faster than they're programmed to. In the latter film, two investigative reporters uncover a plan to replace world leaders visiting the expensive resort with identical androids. All these films share a concern for retaining our humanity in the face of increasingly complex and sophisticated technology. —B.C.

Coma, 112 min., color, 1978. Director: Michael Crichton. Distributor: Films Inc.

Advanced hospital technology is exploited to produce a black market in human body parts until a young woman doctor gets wise. A graphic behind-the-scenes look at a modern big-city hospital provides the background for an above-average thriller. —B.C.

Future Shock, 42 min., color, 1972. Director: Alex Grasshoff. Distributor: McGraw-Hill Films.

Documents and provokes questions about the linkages between rapid technological change through inventions and the reactions of humans, individually and in groups. Useful to dramatize and stimulate thinking about the necessity of inventors in all fields to "stand upon each other's intellectual shoulders" in order to make progress toward their goals and those of society. Narrated by Orson Welles, from the book by Alvin Toffler. —S.J.

Genetics: Man the Creator, 18 min., color, 1976. Producer: Hobel-Leiterman. Distributor: Document Associates.

The advances in genetic research and the question of who is to decide how these advances are to be applied to human genetics, beginning with a brief description of how the science of genetics has allowed man to create sperm and egg banks and use artificial insemination to initiate human development. Also shows some of the more advanced genetic experiments that are occurring today. Among these are the development of a calf in an artificial womb, cloning of frogs, and the possibility of man-animal hybrids for specific tasks. After presenting some of the more emotional topics, shows a family with genetically defective children and notes that genetic engineering can be used to prevent many cases of deformed children. A discussion starter on the ethics of greater technical advances in genetic engineering. —C.S.

Knowledge or Certainty, 52 min., color, 1974. Producers: BBC-TV & Time Life Films. Distributor: Time Life Multimedia.

Scientist/philosopher Dr. Jacob Bronowski examines the personal dilemmas that confront today's scientists when technology is pitted against moral/ethical issues. He contrasts the possible benefits of harnessing nuclear energy with the development of the atomic bomb. From the highly acclaimed television series *The Ascent of Man.* —C.A.E.

Leisure, 14 min., color, 1976. Director: Bruce Petty for Film Australia. Distributor: Pyramid Films.

Slick animation parallels (from cave to city) technological advancement with man's changing concept of leisure. Notes that leisure—not technology—is now the biggest challenge for the masses, especially since work no longer takes up most of our waking hours. —J.T.

The Other Way, 26 min., color, 1974. Producer: BBC-TV. Distributor: Time Life Multimedia.

Noted economist E. F. Schumacher, one of the first to foresee the recent energy crisis, points out the enormous waste of energy resulting from our dependence on massive technology. Nuclear power, he asserts, uses up far more energy to create and maintain than it will ever provide. He urges developing Third World nations "entering the 20th century" to employ an "intermediate technology," making greater use of human and animal labor, rather than fall for the lure of material benefits offered by modern, high-power technology. The importance of Schumacher's concepts is blunted by the dull, unimaginative presentation. —B.C.

The Paper Prison: Your Government Records, 56 min., color, 1974. Director: Dick Roy for ABC-TV News. Distributor: Macmillan Films.

Investigates the uses and abuses of information amassed by government agencies on U.S. citizens, often without their knowledge. This film was inspired by a four-year study by a U.S. congressional subcommittee, and covers certain aspects of the invasion of an individual's right of privacy in the U.S. today. —J.M.

Terror: To Confront or Concede?, 55 min., color, 1975. Producer: BBC-TV. Distributor: Time Life Multimedia.

Confronts the modern dilemma of whether to "confront or concede" to the (extortion) threats of terrorist organizations. Questions what a government's position should be in order to save an innocent life or lives. Includes clips from a Uruguayan revolutionary propaganda film and still photos and newsreel clips about terrorist activity in Germany, Sweden, Israel, and England. This film presents the case for "innocent victims of indiscriminate terror," while at the same time arguing against the total suspension of civil rights in combating terrorism. Could be used to relate a consideration of "controlling technology" to that of controlling (limiting) an individual's freedom in today's society. —J.M.

15 Assessing and Directing Technology

Before the Mountain Was Moved, 59 min., color, 1968. Director: Robert K. Sharpe. Distributor: McGraw-Hill Films.

Poor Appalachian residents organize politically in order to appeal to the West Virginia legislature to pass a law controlling the strip-mining which has damaged their homes, endangered their lives, and despoiled their environment. A beautifully made and moving film which clearly demonstrates the negative effects of uncontrolled industrial development and also how ordinary citizens can work within the legal system to protect their rights. —N.C.

Buffalo Creek Flood: An Act of Man, 39 min., color, 1975. Director: Mimi Pickering. Distributor: Appalshop Films.

On the morning of February 26, 1972, a series of three coal waste dams on Buffalo Creek in Logan County, West Virginia, gave way. 124 people died; 1,100 were injured; 4,000 were left homeless; property damage was over $50,000,000. This film indicts America's largest independent coal company for purposefully obstructing and opposing the existing mining safety laws. Also exposes the dangers of indiscriminate strip mining, and aims to make the coal company and the U.S. government face their responsibility for greater ecological controls. —J.M.

Bulldozed America, 25 min., b&w, 1965. Producer: CBS-TV News. Distributor: Carousel Films.

A hard-hitting, disconcerting, damning indictment of what economic greed, development, and population growth are doing to the landscape of America. The examples and facts are somewhat dated, but the impact of the message is nonetheless potent: a succession of vignettes shows how the countryside has been paved, polluted, gouged, as well as desecrated by road signs and abandoned autos. —J.M.

Evolution by DNA: Changing the Blueprint of Life, 23 min., color, 1976. Director: Roger Hagen. Distributor: Document Associates.

A documentary focusing on genetic research and its potentials and pitfalls. Dr. Suzuki of the University of British Columbia explains the construction of a DNA string and how cells differentiate and mutations may be created. He also conjectures on the application of genetic research to human beings. Possibly one day man will be able to regenerate severed limbs or, on the negative side, be able to produce biological weapons that could selectively wipe out a given race. Dr. Suzuki advocates the idea that the public should be directly involved in the decision-making process with regard to genetic engineering, in order to minimize the possibility of misusing genetic information. —C.S.

The Living Filter, 17 min., color, 1972. Director: Dr. William Sopper. Distributor: Hornbein-Wood Films.

Describes research being done at Pennsylvania State University on the desirability of recycling water wastes as fertilizers. Details the spray system used to spray the treated water onto test plots and a test section of land that has been strip-mined. This particular method of fertilizing the strip-mined land was the only method to produce regrowth of trees and shrubs. The film is excellent for showing a single case where more technology might be of benefit to society. —C.S.

Things to Come, 92 min., b&w, 1936. Director: William Cameron Menzies. Distributor: Kit Parker Films.

A group of scientists and technologists leads the rebuilding of civilization after a barbarous 30-year world war. By 2036, they are ready to shoot a space capsule to the moon before an artist leads the people in a revolt against progress. Stunning glorification of technological growth is based on an H. G. Wells story. The final question posed is: "All the universe or nothing. Which shall it be?" —B.C.

Where Did the Colorado Go?, 60 min., color, 1974. Producer: WGBH-TV, Boston. Distributor: Time Life Multimedia.

The history of how water from the Colorado has been used and how the uses have affected the river. The film is critical of the various water management techniques that have been applied to the river causing the river to "die" in a salt marsh in Mexico before it ever reaches the ocean. The focus shifts to current management techniques and the water needs of the Southwest for the near future. The film is good to initiate discussion about man's wisdom in applying technology, as opposed to the view that the advance of technology is laying waste the earth's resources. —C.S.

Additional Resources

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Educational Film Library Association. *American Issues Forum: Film List*. New York: EFLA, 1975. Annotated list of over 200 films covering the American Issues Forum calendar of nine monthly issues (36 weekly subtopics) that provide a framework for the exploration of matters of common concern to all citizens. Includes sections on "Working in America" and "The Business of America."

———. *Moral Choices in Contemporary Society*. New York: EFLA, 1977. EFLA service supplement covering Science and Morals, The Morality of Work and Sport, and The Morality of Business.

———. *Oceans: Our Continuing Frontier*. New York: EFLA, 1976. Includes films on explorations and mineral resources of the sea.

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Appalshop Films, Box 743, Whitesburg, KY 41858.

Association Films, 866 Third Avenue, New York, NY 10022.

Audio Brandon Films, 34 MacQuesten Parkway So., Mount Vernon, NY 10550.

Best Films, P.O. Box 692, Del Mar, CA 92014.

Bosustow Productions, 1649 Eleventh Street, Santa Monica, CA 90404.

Bowling Green Films, Inc., Box 384, Hudson, NY 12534.

California Newsreel, 630 Natoma, San Francisco, CA 94103.

Carousel Films, Inc., 1501 Broadway, New York, NY 10036.

Castelli-Sonnabend, 420 West Broadway, New York, NY 10012.

The Center for Documentary Media, Inc., 1290 Madison Avenue, New York, NY 10028.

Centron Films, 1621 West Ninth Street, Lawrence, KS 66044.

Cine Information, P.O. Box 315, Franklin Lakes, NJ 07417.

Corinth Films, 410 East 62 Street, New York, NY 10021.

Document Associates, 211 East 43 Street, New York, NY 10017.

Encyclopaedia Britannica Educational Corp., 425 N. Michigan Avenue, Chicago, IL 60611.

Film Images, 1034 Lake Street, Oak Park, IL 60301.

Filmakers Library, 290 West End Avenue, New York, NY 10023.

Films for the Humanities, P.O. Box 2053, Princeton, NJ 08540.

Films Inc., 733 Green Bay Road, Wilmette, IL 60091.

Stuart Finley, 3428 Mansfield Road, Falls Church, VA 22041.

Focus International, 1 East 53 Street, New York, NY 10022.

Forbes Magazine, 60 Fifth Avenue, New York, NY 10011, Attn: Timothy Forbes.

Christopher Gamboni, 29 Crystal Beach Boulevard, Moriches, NY 11955.

Golden Films, Stewart House, Windsor, Berks, England.

Green Mountain Post Films, P.O. Box 177, Montague, MA 01351.

Handel Film Corp., 8730 Sunset Boulevard, West Hollywood, CA 90069.

Helios Flying Studio, 90 Tappan Landing Road, Tarrytown, NY 10591.

Victoria Hochberg, 6825 Alta Loma Terrace, Hollywood, CA 90068.

Horbein-Wood Films, Box 174, Lemont, PA 16851.

Hurlock Cine-World, 13 Arcadia Road, Old Greenwich, CT 06870.

Image Resources, P.O. Box 315, Franklin Lakes, NJ 07417.

Images, 2 Purdy Avenue, Rye, NY 10580.

Indiana University, Audio-Visual Center, Bloomington, IN 47401.

International Film Bureau Inc., 332 South Michigan Avenue, Chicago, IL 60604.

International Rehabilitation Film Review Library, 20 West 40 Street, New York, NY 10018.

Janus Films, 745 Fifth Avenue, New York, NY 10022.

Journal Films, Inc., 930 Pitner Avenue, Evanston, IL 60602.

Learning Corp. of America, 1350 Avenue of the Americas, New York, NY 10019.

Lucerne Films Inc., 7 Bahama Road, Morris Plains, NJ 07950.

Macmillan Films, Inc., 34 MacQuesten Parkway So., Mount Vernon, NY 10550.

Malibu Films, P.O. Box 428, Malibu, CA 90265.

Manteca Films, P.O. Box 315, Franklin Lakes, NJ 07417.

McGraw-Hill Films, 110 15th Street, Del Mar, CA 92014.

Modern Talking Picture Service, 2323 New Hyde Park Road, New Hyde Park, NY 11040.

Arthur Mokin Productions, 17 West 60 Street, New York, NY 10023.

Museum of Modern Art, Dept. of Film Circulation, 11 West 53 Street, New York, NY 10019.

National Film Board of Canada, 1251 Avenue of the Americas, 16th Floor, New York, NY 10020.

New Day Films, P.O. Box 315, Franklin Lakes, NJ 07417.

New Line Cinema, 853 Broadway, New York, NY 10003.

New York Telephone Film Library, c/o Association Films, 866 Third Avenue, New York, NY 10022.

New Yorker Films, 16 West 61 Street, New York, NY 10023.

Paramount Pictures Corp., Non-Theatrical Division, 5451 Marathon Street, Hollywood, CA 90038.

Kit Parker Films, P.O. Box 227, Carmel Valley, CA 93924.

Penny Lane Films, 100 W. Industry Court, Deer Park, NY 11729.

Perspective Films, 369 West Erie Street, Chicago, IL 60610.

Phoenix Films, Inc., 470 Park Avenue South, New York, NY 10016.

Pictura Films, 111 Eighth Avenue, Room 900, New York, NY 10011.

Pyramid Films, Box 1048, Santa Monica, CA 90406.

Walter Reade 16, 241 East 34 Street, New York, NY 10016.

Sterling Educational Films, 241 East 34 Street, New York, NY 10016.

Swank Motion Pictures, 201 S. Jefferson Avenue, St. Louis, MO 63166.

Third World Newsreel, 160 Fifth Avenue, Room 911, New York, NY 10010.

Time Life Multimedia, Time & Life Building, 1271 Avenue of the Americas, New York, NY 10020.

Trainex Corp., 12601 Industry Street, Garden Grove, CA 92641

United Artists/16, 729 Seventh Avenue, New York, NY 10019.

Universal/16, 445 Park Avenue, New York, NY 10022.

University of California, Extension Media Center, 2223 Fulton Street, Berkeley, CA 94720.

Viewfinders, P.O. Box 1665, Evanston, IL 60204.

Gary A. Walkow, 8508 Appian Way, Los Angeles, CA 90046.

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